November 7, 1918 American Machinist Vol. 49, No. 19

THE GLEASON Bevel Gear Planing Machine, Automatic, 25-Inch TWO TOOL GENERATING TYPE

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Anyone whose work involves bevel gears in any way, especially those of considerable size, will be interested in the latest machine to be manufactured by the Gleason Works for producing these parts. It is believed that this is the first machine to be placed on the market that will generate bevel gears of one diametral pitch on a production basis.

THE machining of heavy bevel gears with such accuracy that they would work smoothly and quietly when in use is a matter that has caused more or less trouble, and with the idea of providing a machine that would turn out these gears on a production basis in mind the 25-in. automatic bevel-gear planing machine, two-tool generating type, shown in the illustration has recently been developed by the Gleason Works, Rochester, N. Y. The maximum capacity of the new machine is gears with teeth of 1 diametral pitch, and it is believed that this is the first machine that has ever been placed on the market for generating bevel gear teeth of this size on a commercial basis.

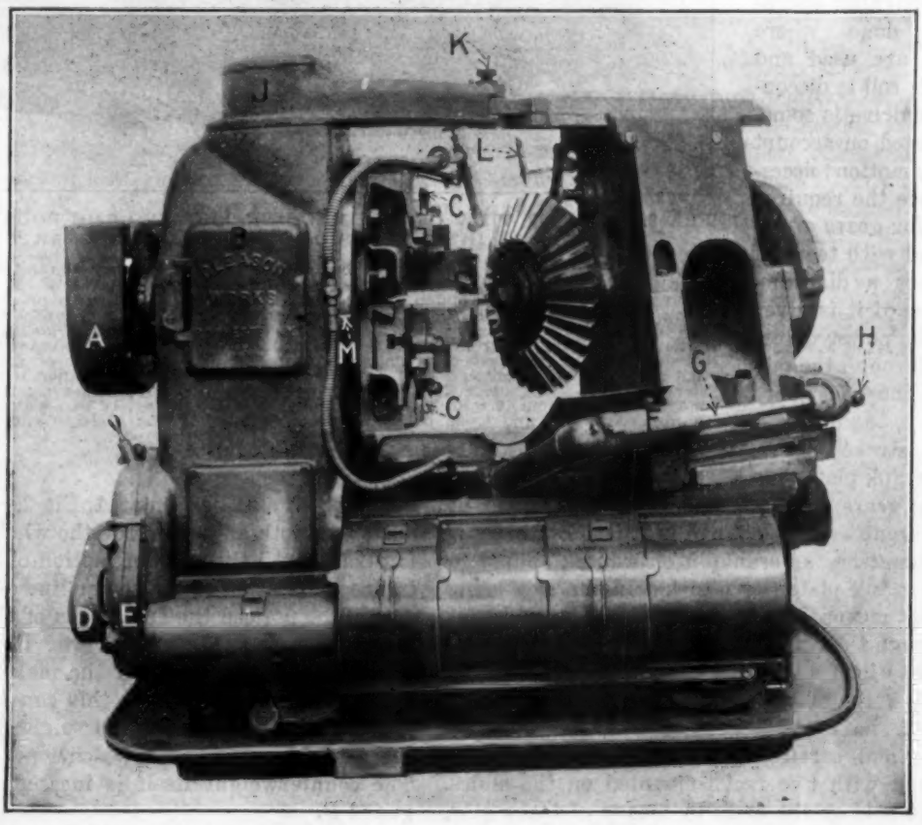


FIG. 1. A BACK VIEW OF THE 25-IN. AUTOMATIC BEVEL-GEAR PLANING MACHINE OF THE TWO-TOOL GENERATING TYPE

The previous experience of the company with this line of machines has been made use of, and the result is a machine that is notable for its general compactness and stiffness. Its compactness has been increased by incorporating a geared connection for the generating roll, and its stiffness is greatly enhanced by the overarm connection between the head and the housing. In a machine of this kind the greatest part of the power is, of course, taken by the cutting tools, and in order to make the drive to these as direct as possible they have been mounted on one side of the housing while the driving pulley is placed at the other side, with only such mechanism as is absolutely necessary interposed between. The directness of this connection between the pulley and the tool slides may be seen by referring to the drive diagram, Fig. 5, and also to the cross-section shown in Fig. 6. This construction allows the gearing, telescoping shafts, etc., necessary to connect the moving parts, to be used on sections of the drive where less power has to be transmitted. A complete lubrication system has been

incorporated, and this not only saves time in oiling but always insures proper lubrication.

In designing the machine the fact was taken into consideration that it is often desirable to rough and finish a gear without removing it from the spindle, and the construction has been made such that a change can be made quickly from one set-up to the other. In roughing operations stepped tools are used and the generating roll is not in operation. The gib on the slides carrying the cutting tools is of the taper form, which permits the slide to be made narrower and thus interfere less with the projecting end of the gear hub or the arbor on which the gear is mounted. As on previous generating gear-planing machines made by this company two cutting tools are used. This construction increases the speed and minimizes vibration, interference of the tools being avoided by alternating the slides. The two tools operate on opposite sides of the same tooth and thus one tooth is completed for each generating operation. Fig. 1 shows the machine completing a tooth on the finishing operation, while Figs. 2 and 3 show roughing operations being done where stepped tools are used and the generating roll is disconnected. As the drive is somewhat complicated on account of the various motions necessary to produce the required tooth curves for gears of various sizes and with teeth of various pitches a diagrammatical outline of it is given in Fig. 5. The power enters the machine through the pulley inside of the bolt guard at *A*, Fig. 1, and passes through the stroke change gears to the crank plate. The stroke change gears are used to change the number of strokes per minute and the change in length of stroke is secured by mounting the crankpin on a block sliding in a slot in the crank plate, its position in the slot being determined by means of an adjusting screw which is operated through the door shown at *B* in the upper part of the column, Fig. 1. The rod connected to the crankpin takes the form of a rack meshing with a pinion mounted on a shaft which projects through the generating plate and carries on its outer end a second pinion meshing with two racks mounted on the slides. The slides are held on the arms by means of taper gibs, an adjustable gib being placed on the upper side of the upper slide and on the lower side of the lower slide. This allows each slide to be taken up with a single taper gib, the one for the upper slide being adjusted from the front of the machine and the one for the lower from the back. The lower arm is bolted directly to the generating plate while the upper arm is movable in order that adjustment may be made for the various tooth angles required for different gears.

The proper angle between the two arms is secured by means of the worm and wormwheel sector adjustment, which may be seen at *A*, Fig 2. After this adjustment for tooth angle is made the whole generating plate is turned until the lines of motion of the two slides are in proper relation to the center line of the work spindle. As will be noticed the front ends of the arms and slides project considerably in front of the generating plate (Fig. 2 shows the front of the machine), and in order to avoid any stress due to this considerable amount of overhanging metal a counterweight has been provided, the connecting cable for which may be seen in Fig. 2. The counterweight itself is incased in the sheet-metal guard *B*.

The clapper boxes are held on the slides by means of T-slots and bolts, *A* and *B*, Fig. 3, and the toolholders

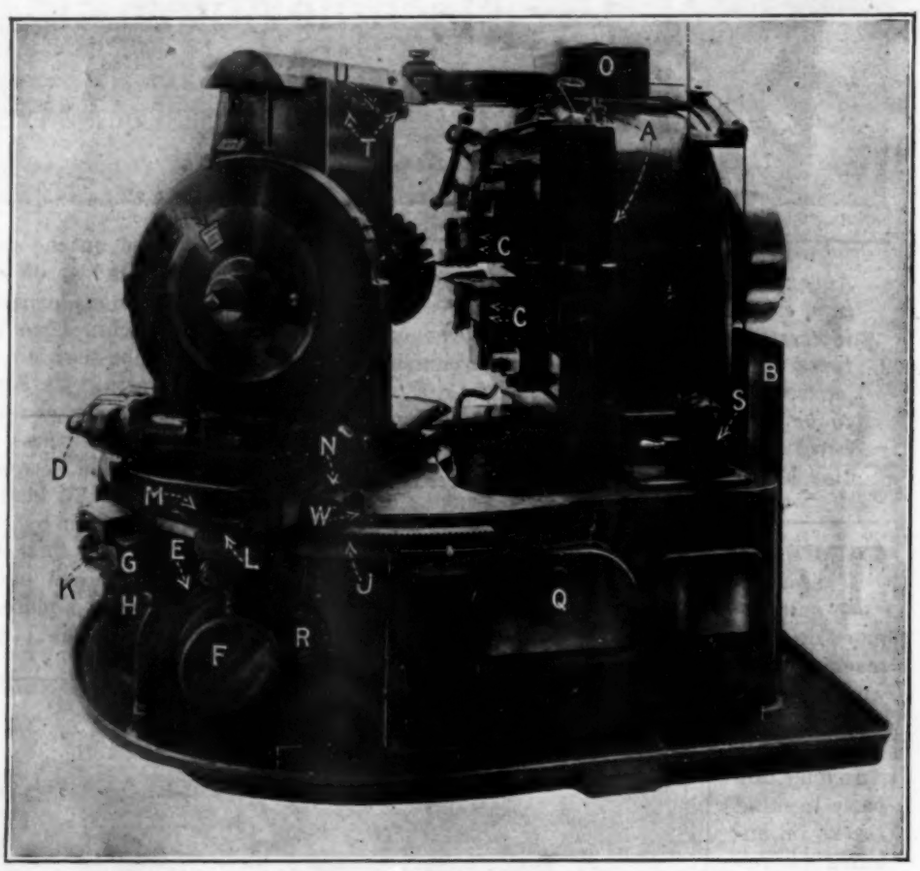


FIG. 2. A FRONT VIEW OF THE MACHINE, SHOWING THE ROUGHING OPERATION IN PROGRESS ON A HEAVY BEVEL GEAR

Longest cone distance of any gear that can be planed, 17¾ in.; shortest cone distance of any gear that can be planed, 1 in.; greatest pitch angle of any bevel gear, 82 deg. 53 min.; least pitch angle of any bevel pinion, 7 deg. 7 min.; greatest pitch angle of any angular gear, 90 deg.; extreme ratio of any bevel gear, 8 to 1; largest pitch diameter of 8 to 1 ratio bevel gear, 35½ in.; largest pitch diameter of 2 to 1 ratio bevel gear, 31¾ in.; largest pitch diameter of any miter gear, 25 in.; least number of teeth in miter gear, 15; largest diametrical pitch, 1; longest face, 6 in.; greatest distance from center of machine to nose of spindle, 20 in.; fastest tool speed, 105 strokes per minute; slowest tool speed, 25 strokes per minute; adjustment of stroke, 1 to 6 in.; fastest time in which one tooth can be cut, 32 sec.; slowest time in which one tooth can be cut, 9 min. 20 sec.; diameter of drive pulley, 16 in.; width of drive belt, 4 in.; diameter of tight and loose pulleys on countershaft, 12 in.; speed of countershaft, 400 r.p.m.; speed of drive pulley on machine, 500 r.p.m.; horsepower required, 7½; estimated net weight, 11,500 lb.; floor space, 75 x 95 in.; height, 70¾ in.

C are held forward during the cutting stroke and backed off during the reverse stroke by means of cams operated by a rack-and-pinion mechanism. One of these is shown in Fig. 3. This mechanism is inclosed in the tool block *D*, the rack *E* projecting back through the friction block *F*. As the tool block moves toward the front of the machine the friction on the rack causes it to turn the small gear and back off the tool so that it does not touch the work during the reverse stroke. At the beginning of the cutting stroke, however, the friction on the rack again moves the gear and cam, causing the tool

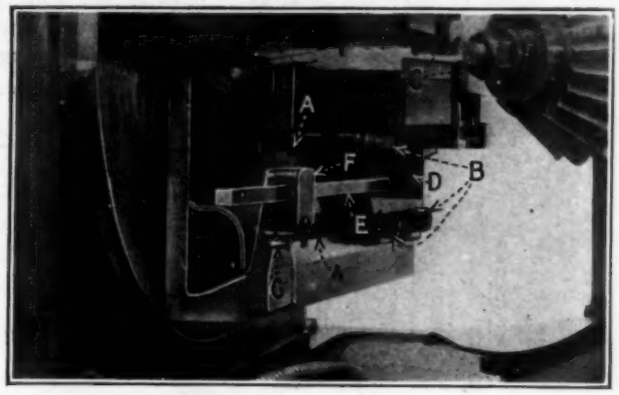


FIG. 3. A CLOSE VIEW OF THE LOWER ARM, SLIDE AND TOOLHOLDER

to be advanced into cutting position. The friction on the rack is obtained by means of washers of brake-lining material, a flat spring and a lever having a cam-shaped end, so that the friction may be thrown out of operation when the tools are being set. These levers may be seen at *C*, Fig 1, and also at *G*, Fig. 3.

Pressure Angle

The correct pressure angle for the finishing tools is secured by manufacturing the cutters themselves to the proper angle (this relieves the operator of the necessity of grinding the angle), while the adjustments for length and height are made by means of wedges, the adjusting screws for which may be seen projecting from the front of the tool block at *C*, Fig. 2. The tools are made with the same shape for their entire length, a feature allowing them to be resharpened by simply grinding off the front face, an operation that may be repeated until only a small portion is left. Gages are provided for setting the tools to the proper length and height, the gage for height also serving to check the setting of the tool in regard to pressure angle. All gages have proofs furnished with them.

Drive for the Feed and Work

Returning to the driving pulley there is a miter gear on the main shaft between the driving pulley and the stroke change gears. This meshes with a second gear on the vertical drive shaft which leads to the cradle drive-bracket assembly. This assembly carries the feed change gears and the mechanism for driving the two pumps, one of these being for the circulation of lubricating oil and the other for the circulation of cutting compound. The feed change gears are located under the cover at *D*, Fig. 1. From these change gears the drive is to the reverse-mechanism drive shaft located just forward of the shaft carrying the reverse clutch shown at *A*, Fig. 4. This reverse clutch is operated from the cam *B* through the rod *C* and lever *D*. The end of the shaft carrying the reverse clutch projects through into the space under the guard *E*, Fig. 4, and *E*, Fig. 1, and carries one of the roll change gears, which are for imparting to the generating plate the proper amount of roll. This is accomplished through a set of spur gears, a set of bevel gears, and a worm and wormwheel sector, the latter being mounted on the generating plate.

From the other end of the reverse-mechanism drive shaft the drive is to the shaft *F*, Fig. 4, which is part of the index and differential bracket assembly. This connects to the front shaft *G* of the differential assembly, which carries the locking mechanism *H* for the indexing movement. This is operated by a dog on the other side of the camplate *B*, through the lever *J* and the small rod *K*. The construction of this mechanism is such that the shaft is locked against motion in either a backward or forward direction while the index

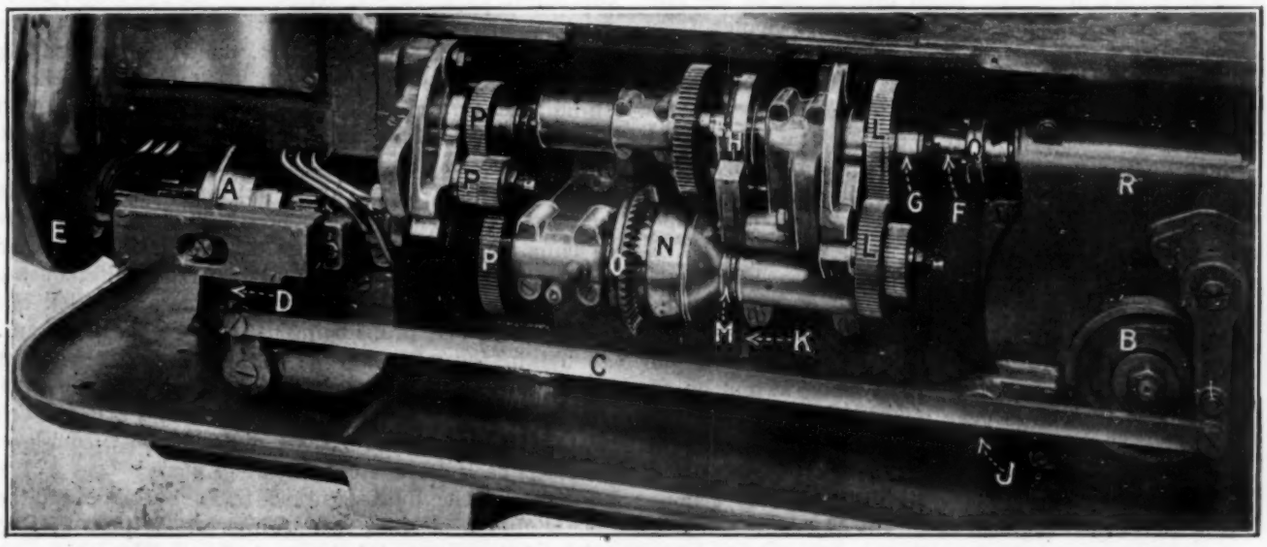


FIG. 4. A VIEW OF SOME OF THE NECESSARY GEARING AT THE BACK OF THE MACHINE WITH COVERS AND GUARDS REMOVED

mechanism is not in motion. From here the drive is through the index change gears *L* to the shaft *M* which carries the differential *N*, the bevel drive gear *O* for the head assembly and the first of the ratio of roll change gears *P*. The last of the ratio of roll change gears connects directly with the roll change gears by means of a shaft extending through the lower, or overhanging, part of the column, the differential previously mentioned serving to combine the indexing motion and the generating roll of the work so that only one train of gearing needs to be carried from the differential up to the index wormwheel.

The bevel gear *O* mounted on the end of the differential is connected to a short vertical shaft located on a vertical line drawn through the cone center of the machine by means of a short horizontal shaft and two sets of bevel gears. From here the drive continues up around the base of the head assembly through the casing *F*, Fig. 1, and through the telescoping shaft *G* to the index wormshaft, the end of which may be seen projecting at *H*. The position of this index wormshaft and the index wormwheel can be seen somewhat better in Fig. 2. At the end of the index wormshaft at *D* is a fine-toothed clutch, the use of which will be spoken of later. The telescoping shaft *G*, Fig. 1, is made necessary by the movement of the head along the line of the axis of the work spindle in adjusting for proper cone distance.

Feed Mechanism

Returning to the index and differential bracket assembly there is a coupling *Q*, Fig. 4, mounted on the end of the rear shaft, this connecting to the feed worm located in the casing *R*. The wormwheel shaft carries the cam *B* at one end and the feed cam *E*, Fig 2, at the other. The camplate *B*, Fig. 4, is in reality a double cam, the slot shown operating the reverse trip through the rod *C* and lever *D*, while the dog on the reverse side operates the index trip through the lever *J* and rod *K*.

The feed cam has two grooves, one for finishing and one for roughing, the cam being slid along the camshaft until the proper groove is in position by means of a quick-acting screw located just beneath the cover *F*, Fig. 2. As previously noted this is one of the features of the machine, it being possible to change from roughing to finishing or vice versa without undue delay. The cam roller is double, one part bearing on each side of the groove and carried on a lever, the end of which may be seen at *G*, Fig. 2. The whole lever swings on the vertical bearing *H*, and the amount of motion imparted to the gear segment *J*, and hence the head, is controlled by altering the position of the pin connecting the lever and the segment. The pin is mounted on a sliding block, which is moved back and forth along the cam lever by means of a screw, the square head of which may be seen at *K*. The motion imparted to the head by the cam and cam lever is only for the purpose of feed, the head being swung on the base and on the large gear segment to adjust for the angle of various gears by means of the pinion *L* which is turned by a wrench on a squared shaft in the slot *M*. When set in position, however, the head is clamped firmly to the gear segment by means of T-slots and bolts, one of which may be seen at *N*.

A generating gear planer is, of course, a somewhat complicated machine on account of so many different motions being introduced, and, as stated at the beginning, it has been the intention of the makers of this machine to reduce the complication as much as possible and make this machine simple. To facilitate this the unit-assembly idea has been followed all through, the various units being assembled independently and then the complete set built up into a finished machine. It is interesting to note that complete jigging has been used throughout in order to insure interchangeability of all parts except those where a hand-scraped fit is necessary. Some of the individual assemblies entering into the makeup of the machine are the reverse bracket assembly; index bracket assembly; head unit, consisting

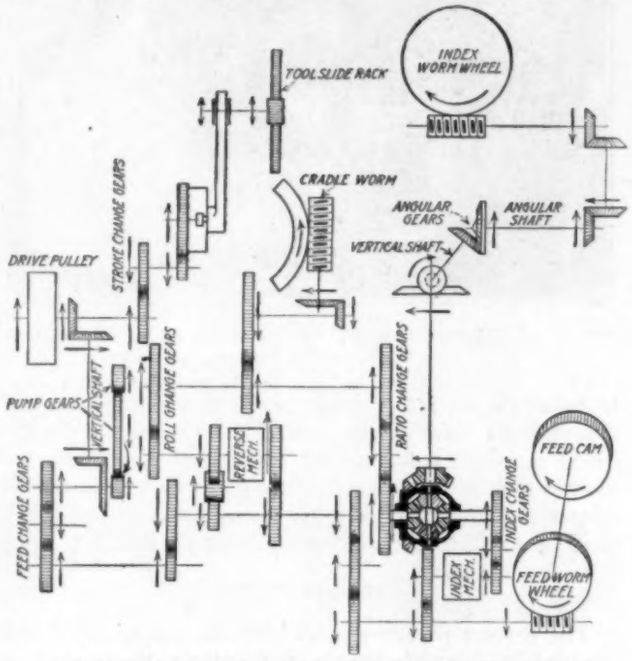


FIG. 5. DIAGRAMMATIC SKETCH OF THE DRIVE

of the index worm bracket, angular drive-shaft bracket, head, head cap, overarm, spindle, swinging base and index wheel; upper cam-lever and T-slot segment; lower cam lever; cam bracket; feed-wormwheel bracket; automatic stop; crank-plate bracket; upper and lower drive brackets; cradle-worm bracket, and the generating plate, which includes the arms, slides and clapper boxes. In building up the machine from the assemblies the oil pan is first laid down and the frame fastened in place. The top of the frame is then surfaced and the T-slot segment scraped to fit, after which the swinging base and head assembly are dropped into place. The bare housing is then placed on the base, and with the head assembly swung to 90 deg. with the frame the housing is indicated true with the head spindle and bolted and doweled in place, shims being used at the bearing points to obtain the necessary adjustment. The generating plate, which has already been assembled with the housing, is now put in place, after which the arms, slides, clapper boxes, reverse bracket, index bracket, cam-lever bracket, back drive, etc., are put in place.

Some of the limits worked to in building and assembling the machine are of interest, as they give an idea of the quality of the work done. The head must align with the center of the machine with regard to

height, twist and center to 0.001 in. in 12 in.; the ball test for centering the head must prove true within 0.001 in.; the bore of the spindle must be true with 0.0005 in.; the housing square with the head to within 0.001 in. on a 15-in. radius; the housing central to 0.001 in.; the alignment of the overarm with the spindle with regard to twist and height to 0.001 in. in 12 in.; the spacing of the index wheel, 0.003 in.; all shafts are ground to size and all bearing surfaces are hand scraped.

As previously stated a complete oiling system has been incorporated. An oil sump is located in the base, and from this the oil is pumped to the reservoir *J*, Fig. 1, and *O*, Fig. 2, whence it runs by gravity to the various bearings in the housing and base. Some of the oil pipes may be seen at the left in Fig. 4. Oil leads are also brought to the various bearings shown in the gearing assembly, but these had not been put in place when the photograph for the illustration was taken. A similar gravity system is provided for oiling the various bearings in the head, but the oil for this is not pumped. An oil reservoir shown at *P*, Fig. 2, operates on a similar principle except that it must be filled by the operator.

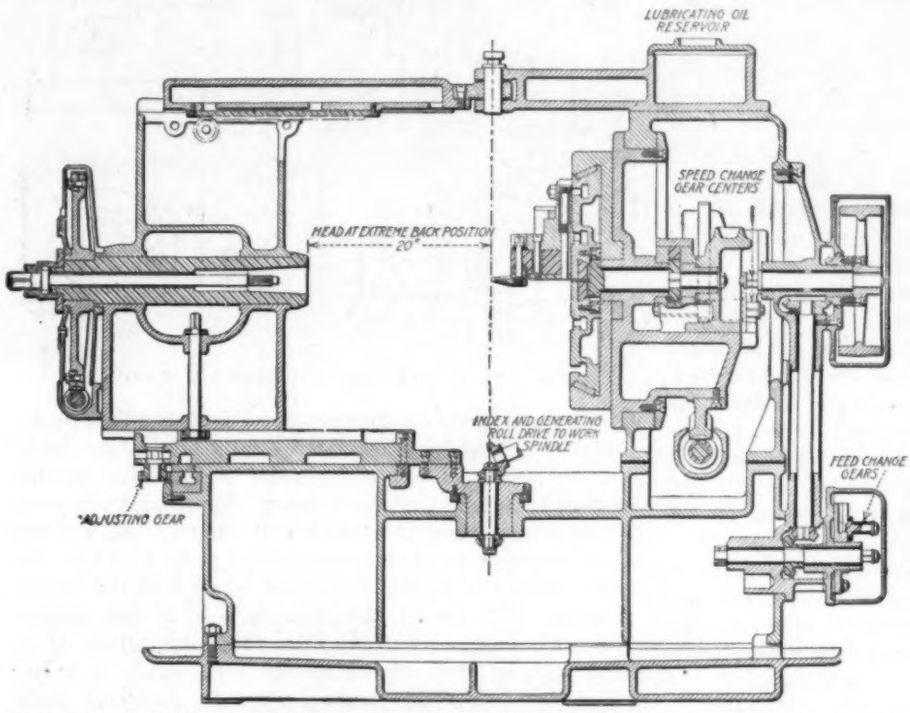


FIG. 4. A CROSS-SECTION OF THE MACHINE WITH THE HEAD AT RIGHT ANGLES TO THE LINE OF TRAVEL OF THE TOOLS

A generous reservoir for cutting lubricant is also located in the base, from where the liquid is pumped to the distributing pipe over the cutting tools. A strainer is provided to remove all chips, and these are removed through the large door *Q*, Fig. 2, at the front of the machine.

Automatic Stop

Another feature of the machine is the automatic stop, which may be set to shut off the power after any given number of teeth have been cut. This may be seen in Fig. 2. The lever *R* projecting from the feed-cam case is connected by a rod to the ratchet-and-pawl mechanism at the right of the machine at *S*. This is connected to the belt shipper by the chain shown, and may be set to operate when any given number of teeth have been completed. When this point is reached the device is tripped and a spring pulls down on the chain and shuts off the power.

The heavy overarm may be seen to best advantage in Fig. 1. The arm projecting from the housing is bolted in place, while the arm connected to the head slides in the top of the head and is clamped in place by means of two bolts, which may be seen at *T*, Fig. 2. The arm is moved along the head by a rack-and-pinion mechanism operated by a crank, or wrench, placed on the squared shaft at *U*. The two arms are fastened together at a point directly over the cone center by the heavy pin *K*, Fig. 1. This pin has two grooves turned in its surface, and a spring-operated pin bearing in one groove holds the pin fast either in the position shown in the illustration or when it is pulled up, so that the overarm secured to the head can be moved back. This prevents the loss of the main pin and is a great convenience. At *L*, Fig. 1, may be seen the stock-dividing gage. This is used when a quantity of gears is being cut, and stocked out first and then rechucked for finish cutting. When the first gear has been remounted for finish-cutting the stock is divided by the tools and the gage set to this gear, so that following gears may be set by the gage alone. As may be seen, several adjustments are possible so as to set the gage in any position. In setting, the gear is placed in the machine and clamped solidly on the spindle, after which the fine-toothed clutch at *D*, Fig. 2 is loosened, when the index wormshaft can be turned until the gear is in the proper position. After adjustment the fine-toothed clutch is again tightened and the set-up is complete. A small pointer is used on the front of the gage and very fine adjustments can be made. The gear being cut is mounted upon a taper-shank arbor that is held securely in the spindle by a through bolt.

A cone-distance gage is also furnished with each machine for setting the gear blank to the proper distance from the tools. This gage fits on the tool block in a similar manner to the gages for setting the tools to length and height and the cone distance is adjusted by moving the head along the swinging base. This movement is accomplished by a rack-and-pinion mechanism, the operating handle for which is located in the open space in the head just below the work spindle. A scale and vernier are provided in order that settings may be quickly and easily made after the set-up is once known.

Another feature is incorporated for checking to see

that the correct change gears have been used to obtain the proper relation betwen the roll of the generating plate and the movement of the index worm. The edge of the generating plate is graduated and its movements can be read over the marker *M*, Fig. 1. A second scale is placed in the rear of the index worm bracket and is provided with a vernier which may be seen at *V*, Fig. 2. By noting the roll of the generating plate and the corresponding movement of the index wormwheel the correctness of the change gears can be checked from a table furnished with the machine.

Scales are also provided for setting the swinging base and for setting to secure the proper angle of motion betwen the tool slides. The former may be seen in *W*, Fig. 2, while the latter is located on the collar of the wormshaft at *A*.

The machine has been arranged for convenience in operation and guards and covers are placed at all dangerous points. These are so made as to be quickly removable when necessary, spring pins being the means of holding the covers in most cases. The pins may be seen at several places on the guards.

In building the machine all running shafts are ground to size and bearing surfaces are hand-scraped. The running bearings are all bronze-bushed, while the thrust bearings are either of the ball type or fiber against steel. All wormshafts are provided with a means for taking up wear. A generous-sized oil pan is an integral part of the machine, this resting on the foundation at three points.

The planing machine is a very interesting piece of mechanism from all points of view, and the ease, rapidity and almost human manner in which it goes through its various complicated motions cannot but excite the admiration of anyone who sees it in operation.

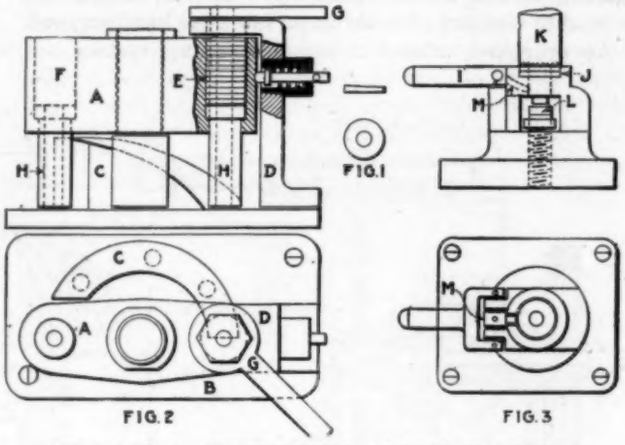
Making Angle-Faced Washers

By F. P. Terry
Belfast, Ireland

A large number of taper washers like the one shown in Fig. 1 were being called for made of duralumin. The first order was for 10,000 and the way we got at the job may be of interest. The blanks were punched accurately to size from sheets, after which they were inserted in the fixture shown at Fig. 2 for drilling the hole. This fixture was built up principally from scrap and is not difficult to make. The holder *A* had previously done duty as the bridge piece of a stop valve, and the baseplate *B* is made from mild-steel plate. The inclined-plane piece *C* was forged and pinned on as was bracket *D*. A number of washers are shown in position for drilling in recess *E* while recess *F* is ready for loading. The washers are clamped by the threaded guide bushing, operated by means of the handle *G*, onto the bolster *H*.

A small sensitive drilling machine is used, and when the washers are in the position the power feed is put on and the operator then loads recess *F*. An automatic trip is used, and when drilling is completed handle *G* is pushed back and holder *A* turned half round, bringing the next dozen washers in position. When turning, bolster *H* travels up *C*, ejecting the finished washers, the operator catching these with his left hand. With this fixture practically continuous drilling is obtained and very little skill is required; in fact the most difficult part at first was to have the hand in position as the washers were ejected, otherwise some fell on the table and the remainder dropped back into the recess when the bolster dropped.

After the drilling the washers are placed in the chuck shown at Fig. 3, which is operated by handle *I*.



FIGS. 1 TO 3. FIXTURE FOR MAKING WASHERS

Beneath the washer a steel washer *J* is placed as a packing piece. It raises the work slightly above the chuck and by means of the counterbore *K* one side of the washer is faced, the depth being regulated by means of the pilot coming in contact with stop *L*. An ejector *M* is arranged in conjunction with handle *I* to lift the work when the handle is pushed down and the chuck released. For facing the opposite side of the washer the same fixture is used, with the substitution of a steel packing piece of exactly the same angle as a finished washer for the packing piece *J*. Although close limits are required for thickness and angle and smooth faces these methods proved very satisfactory.

Emergency Jigs for War-Time Work

By Robert G. Pilkington

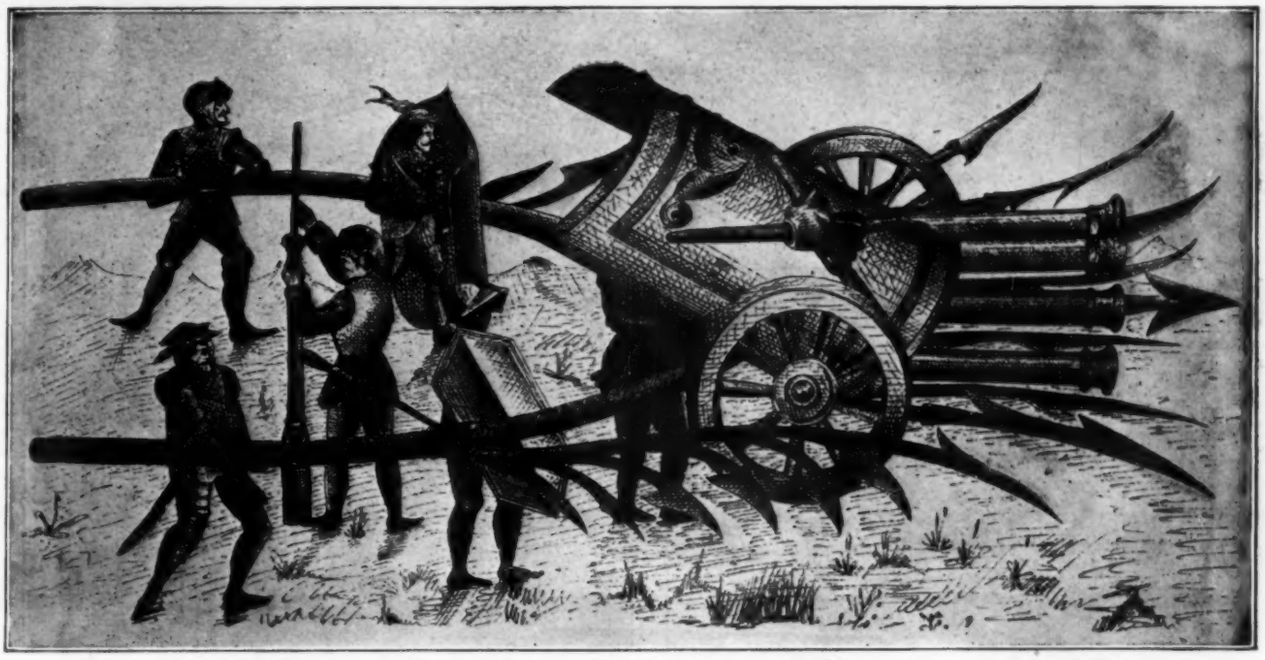
Readers of the *American Machinist* will be interested in knowing how a new motor-truck company provided a complement of temporary drilling jigs with which to begin production.

The company had ordered a large number of pressed-steel frames and of brackets, which were to be riveted to them. All of these brackets had to have a number of rivet holes interchangeably drilled in them.

A large number of frames and brackets had been delivered, but vexatious delays of various kinds were encountered in making the drill jigs and the agents had begun to ask for deliveries.

The president of the company called a conference of the officials most concerned to discuss ways and means, with the result that one of the new frames was dismembered, a short section containing the holes for each bracket cut out, two locating pins riveted in and in half a day the company had a full supply of drill jigs with which to begin work.

The frame makers had provided jigs for locating the holes, which they necessarily had to do to make the frames interchangeable, and the bracket which would fit one frame would fit any of them.



Early Attempts at Rapid-Firing Guns

By H. H. MANCHESTER

In view of the recent discussions over the practicability of certain machine guns attempts to make rapid-firing guns were made almost as early as guns themselves. The more the history of military appliances is investigated the more one discovers that there is no field to which so much thought has been given and where so many inventions have been tried, discarded and revived. This general rule applies to rapid-firing guns as well as other munition of war.

WHILE the first cannon were made about 1313 it was about 1340 before we find notices of hand guns. Yet as early as 1358 we find a record of guns with more than one barrel being used in Holland. The hand gun of that period may best be compared in appearance to a rocket. The barrel was much the shape of the rocket tube and was fastened to a stick for a butt in practically the same way. These early multiple-barreled guns looked accordingly like several rockets on one stick.

These hand guns were of course muzzle loaders, which naturally increased the time required to load them, but it is a striking fact that breech-loading cannon were already being experimented with. Breech loaders are mentioned in the chronicle of Travisano in 1376. They were not, however, entirely loaded from behind, for, curious as it seems, only the powder was put in at the breech, while the ball was put in at the muzzle. There were as yet no shells or cartons for the powder, and of course only priming for ignition.

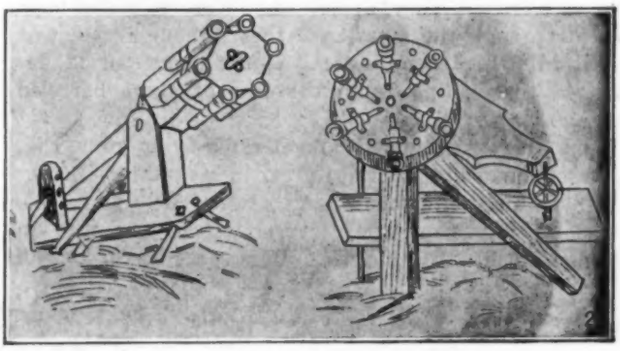


FIG. 2. REVOLVING GUNS, 1390-1405

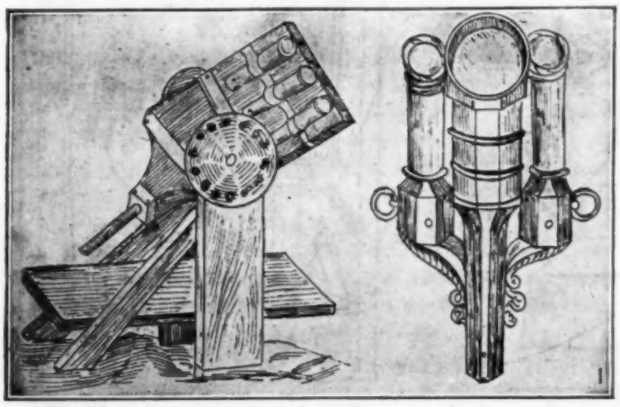


FIG. 1. TWO TYPES OF THREE-BARRELED GUNS, 1390-1405

In 1382 Ghent put into the field 200 so-called cannon carts, the term probably implying several guns on a cart.

The multiplication of barrels to a gun was in many ways the simplest method of increasing the rapidity of firing, and for this reason there was soon a remarkable elaboration of this idea. In 1387, for example, Antonio della Scala had 144 barrels, arranged 12 in a row, and

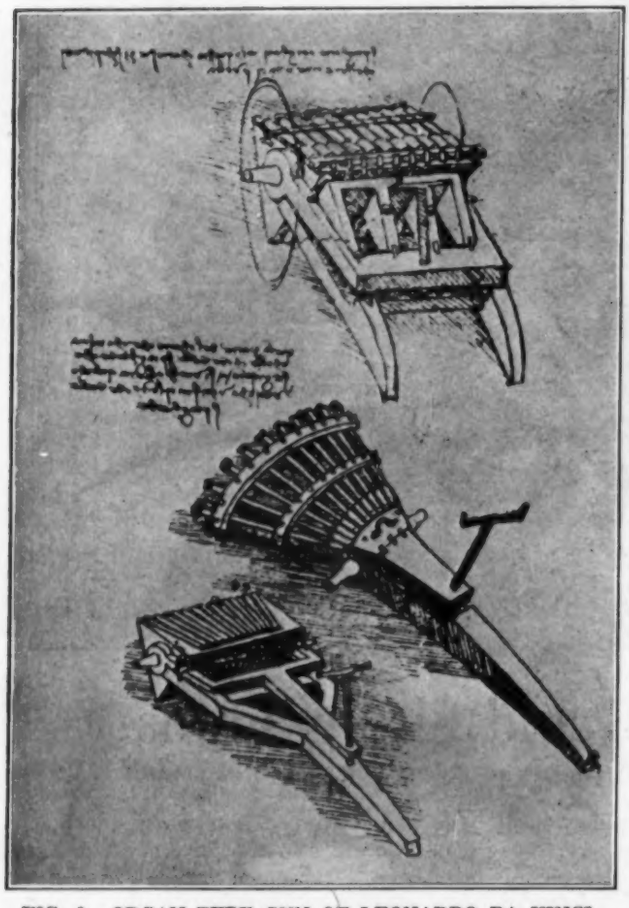


FIG. 6. ORGAN TYPE GUN OF LEONARDO DA VINCI, ABOUT 1500

in such a way that one fuse or train of powder would fire each row. They appear, however, to have been loaded through the muzzle, so that although time was saved in firing them there was the same period demanded for loading as in the case of single-barreled guns.

Several interesting attempts at rapid-firing guns, Fig. 1, were pictured by Conrad Kyeser in his military manuscripts, which date somewhere between 1390 and 1405. Some of these consist of several barrels arranged in parallel form. In this case they were called organ

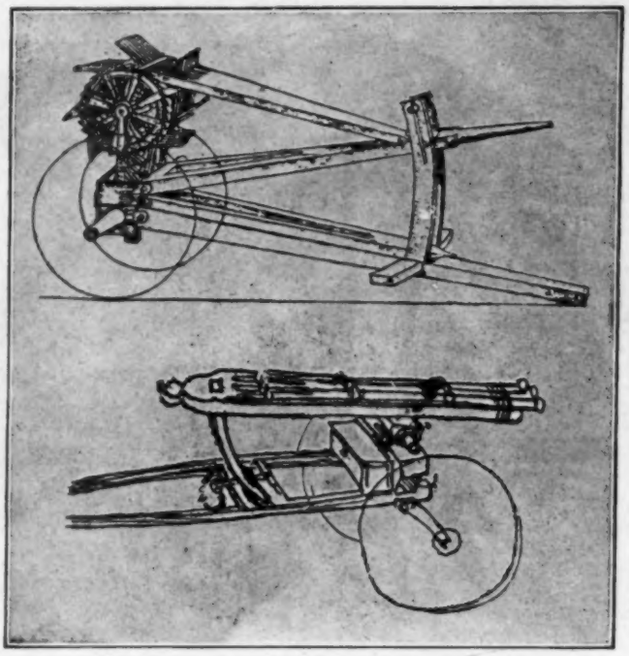


FIG. 7. REVOLVING GUN AND FIELD ORGAN GUN, LEONARDO DA VINCI

guns on account of their similarity to the pipes in an organ.

Although, as mentioned, breech loading was already being attempted we do not find that these first multiple-barreled guns were built on that principle.

More interesting than the organ guns were the revolving ones, Fig. 2, several of which were also shown by Kyeser. These were not as yet supplied with the breech-loading chambers which has given the revolver its name, but consisted simply of six or more barrels fastened around the circumference of a block which could itself be revolved and directed in any way necessary to meet the attack of the enemy. Kyeser's illustrations of these are extremely curious. In particular the gun in which the barrels were fastened to the surface of the disk would have thrown the bullets in such divergent directions that it seems scarcely possible that it could have been put to practical use.

Some of the pictures from about 1400, which show

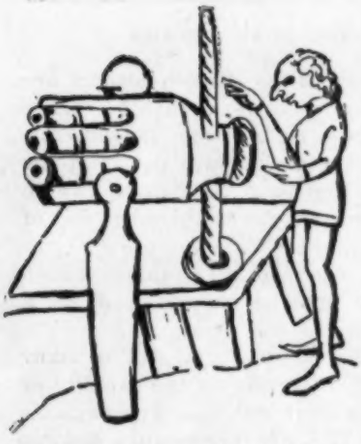


FIG. 3. RAPID-FIRING GUN, ABOUT 1400

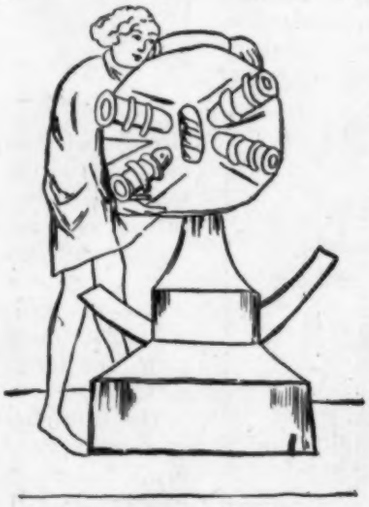


FIG. 4. REVOLVING GUN, ABOUT 1400

FIG. 5. MULTIPLE-BARRELED GUN, FIFTEENTH CENTURY

FIG. 8. MULTIBARRELED GUNS AT THE BATTLE OF MARIANO, 1515

men working multiple-barreled guns, are so grotesque that today they seem almost like caricatures. In one of them, Fig. 3, the base of the gun is run through by an upright post, which is possibly a screw to raise or lower it, and is surely a pivot about which the gun was swung. In another picture from the same manuscript, Fig. 4, the barrels are arranged on the disk to point in different directions, but would not throw their bullets to all points of the compass as in the case of the disk guns mentioned above.

Throughout the fifteenth century we find various notices showing that multiple-barreled, and revolving guns were known and used, Fig. 5, but it must be remembered that artillery was as yet scarce and that only a small proportion of the infantry had guns at all.

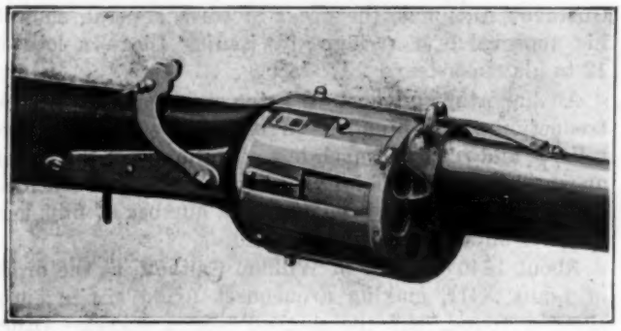


FIG. 9. A REVOLVING ACTION, EARLY SEVENTEENTH CENTURY

With all of Leonardo da Vinci's experience as a military engineer it is only to be expected to find him making designs for rapid-firing guns. Several are of the organ type, Fig. 6, two of which have the barrels spread out like a fan.

Another surprising drawing of da Vinci's, Fig. 7, shows 72 guns arranged around a horizontal axis. The guns are in eight sets with nine guns to a set. Each set points away at a tangent from the circumference of the drum and were supposed to be discharged when the revolution of the wheel brought them on top so that they pointed toward the enemy. Leonardo also made a drawing for breech-loading cannon, but as in previous experiments only the powder and not the ball was to be inserted in the breech.

Several rapid-firing guns are also listed among the inventions which were made about 1500 for Maximilian I of the Holy Roman Empire, but they were not decidedly different from those already noted.

According to Fleurange's memoirs the noted artillery engineer Pedro Navarro made 200 organ guns for Louis XII of France. The barrels were only about two feet long and were arranged to be fired 50 at a round.

That multiple-barreled guns were actually used in war is shown by a plaque illustrating the battle of Mariano in 1515, Fig. 8. In the foreground here we see a field piece with four barrels which was probably made for Francis I. The bas-relief also gives a very good idea of the battle customs of that period, and illustrates how few of the soldiers were as yet supplied with firearms. The field pieces are almost in front of the battle line, and in fact they had to be so placed because their range at that time was only a few hundred feet.

The match or fire lock came in before 1500 and the wheel lock in 1517, but in battle soldiers long carried several yards of tape which was kept lighted between shots and used for igniting the priming.

Hindoo guns with revolving chambers are claimed to date from about 1500, but this is uncertain, and at all events it was charged that these guns had such a tendency to go off all at once instead of one chamber at a time that they were very dangerous.

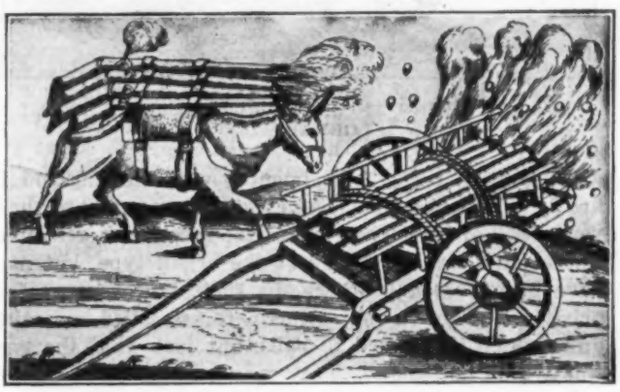


FIG. 10. A MITRAILLEUSE AND A BARRIER GUN, HANZELET LORRAIN, 1630

About the middle of the sixteenth century an important step toward rapid firing was accomplished. The soldiers began to wrap the powder in cartons, a number of which were carried in bandoliers which hung from their belts. In this way the only powder which they had to carry loose was that for priming, which was still kept in a flask. The cartons had the double advantage of saving time and of helping to preserve the powder, but at first the ball was still put in after the powder. Just when the ball was first inclosed in the carton we do not know, but we find the lifeguards of Christian I of Saxony in 1589 carrying cartons which had the ball bound in the neck. Each of these soldiers was sup-

plied with from 10 to 15 such cartridges, which were kept in a case. When the cartridge was inserted in the gun the powder end had to be left open so that the powder would be set off by the priming. For igniting the priming many soldiers still carried when in battle the lighted tape, for the match lock and wheel lock were still hardly to be depended upon.

In the second half of the sixteenth century a simple form of machine gun was devised, which consisted merely in setting up a number of arquebuses on a cart, usually with a shield in front. This gave concentration of fire but added nothing to the speed of firing or loading.

Neither the organ nor the circular arrangement of multiple barrels exhausted the possibilities for rapid-firing guns even at that time, and in the sixteenth century we begin to hear of repeating and revolver guns. In some cases these were probably merely different names for the types already mentioned, and it is often difficult to decide just which type was implied. In 1575

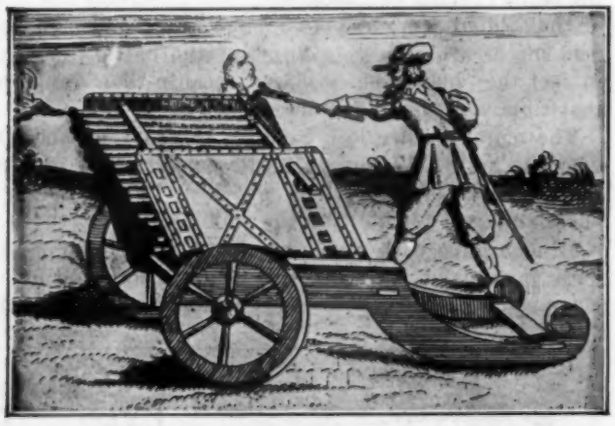


FIG. 11. FIRING AN ORGAN-TYPE GUN, HANZELET LORRAIN, 1630

we find guns being experimented with in England to fire 24 bullets at a time. And the next year 200 of these "engines," and 3000 cartridges for them were delivered. These guns were probably of the organ type, but may have been breech loading. In 1580, however, we find privileges given to John Almain for so-called repeating guns which would fire 10 balls, but just what the type was we do not know. They may have been of the revolver or possibly the magazine class. In the arsenal at Copenhagen is preserved such a repeating gun of the revolver type which is said to date from 1597. The distinction between this type and the previous quick-firing guns is of course that instead of many barrels we find all the balls fired in quick succession through one barrel.

Fig. 9 is a reproduction of a close-up view of the revolving chamber on a gun which dates from about 1600. Still another is preserved from 1620. The difficulty of making this type practical with only priming powder for ignition can well be imagined.

Not long after 1600 Diego Ufano described a machine gun, under the term of mantelet, which had five barrels, all fired by means of one lock. Hanzelet Lorrain in 1630 depicted a four-barreled mitrailleuse, Fig. 10, which was to be fired from the back of a donkey, but neglected to say what the donkey would do in the meantime. In a similar experiment in the War of Secession the mule whirled round and round, and General Grant and his staff dived for the ground and clung to it until the fusilade was over.

Lorrain illustrates in the same picture a cart which could be used as a barricade with the guns pointing through the side. He also depicts the firing of an organ gun, Fig. 11, and shows one of the mantelets, Fig. 12.

Though the machine gun was advancing in favor but

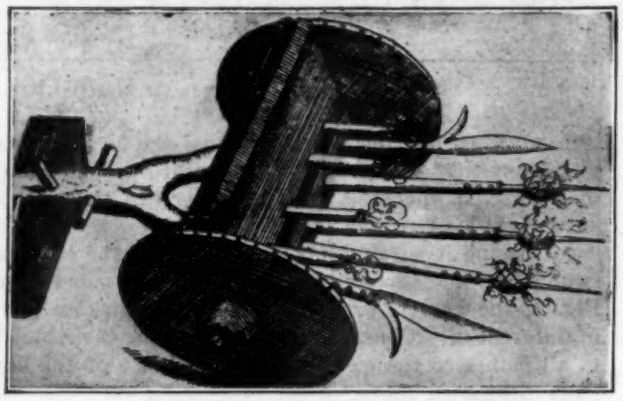


FIG. 12. A MANTELET, HANZELET LORRAIN, 1630

slowly, the use of the cartridge, upon the perfection of which it so much depended, was increasing. In 1625 Gustavus Adolphus, the great Swedish general, showed his approval of cartridges by issuing them in lots of 12 to his musketeers.

An important advance in firing was made by the introduction of the flint lock in 1635. It was much more reliable and required much less attention than the match or wheel lock. The chief way it was applied to machine guns, however, was by setting up a number of flint lock muskets on a cart behind a shield.

About 1640 we hear of William Calthoff, at the order of Louis XIII, making arquebuses firing six to eight shots a round, but the method was a secret. Other secret inventions of rapid-firing guns were made by the

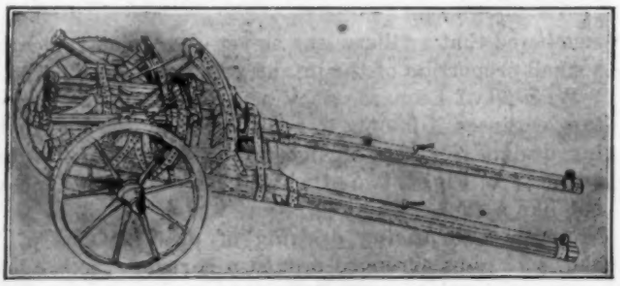


FIG. 13. A SEVENTEENTH CENTURY ADJUSTABLE MULTIBARRELED GUN

Marquis of Worcester about 1660. One seems to have been made with a magazine chamber, but as in the case of the other experiments or inventions of the marquis, he limits his statement principally to the result which the gun was to obtain, and suggests only enigmatically the method of construction. There is evidence, nevertheless, that several machine guns of the marquis were built, tested and accepted by the English government. Possibly the very secrecy with which inventions of machine guns were then surrounded indicates that they were beginning to give promise of results.

Strong testimony to the accomplishments even at that time of rapid-firing guns is given by Pepys in his diary in 1662: "After dinner, was brought to Sir W. Compton a gun to discharge seven times, the best of all devices that I ever saw, and very serviceable and not a bawble; for it is much approved of, and many thereof made."

Porta in 1653 mentions a curious new rapid-firing method for guns, which was probably more of a stunt than an arrangement to be put into practice: "It is a new Invention that a great Brass-Gun or a hand-Gun, may discharge ten or more Bullets one after another without intermission." The secret was to charge the same gun that many times, with a clammy slow-burning powder separating the charges.

But all of these early rapid-firing guns were slow loading, or dangerous, or both, and the successful machine gun had to wait until after the invention of the percussion cap in the first part of the nineteenth century. This eventually made possible the gatling gun of 1865. The idea of making the gun automatic by using the power from the recoil, as in the Maxim gun, or from the gas pressure, as in the Hotchkiss, belongs to the present generation.

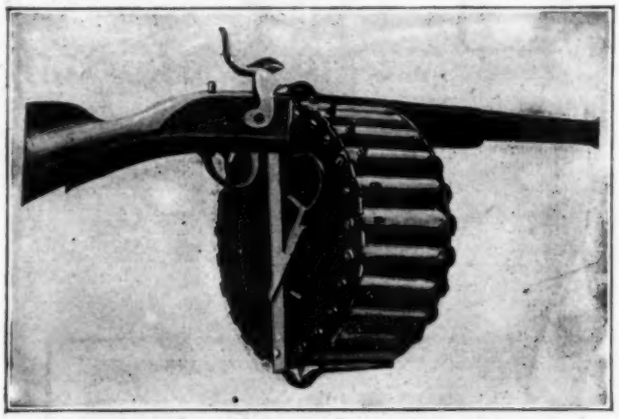


FIG. 14. REVOLVING DRUM ON AN EARLY EIGHTEENTH CENTURY GUN

Thread-Measuring Formulas

BY H. M. FUNNELL

When using the three-wire system of measuring threads the usual formulas given in various popular handbooks are correct only when the thread is standard, because they rely on the outside diameter as the starting point. For example:

Wire reading for U. S. S.—Outside diameter minus $\frac{1.515547}{No.\ of\ thds.}$ per inch plus (3 × diam. of wire).

Wire reading for V-thread—Outside diameter minus $\frac{1.732054}{No.\ of\ thds.}$ per inch plus (3 × diam. of wire).

Occasionally, however, the actual form of the thread is not theoretically perfect; for example, the no-go thread plug gage, which is oversize on the angle only, the top of the thread being often undersize and the bottom in clearance. It is conceivable that the gage-maker might commit an error in using the wires by the usual formula, and it is to reduce the likelihood of error that the following formulas were evolved, based on the "angle root diameter," i.e., the diameter at the root of a theoretical sharp thread, which varies directly as the pitch diameter.

The angle root diameter is obtained as shown:

$$K = \frac{Pitch}{4} \times Cot \frac{(Angle\ of\ Thread)}{2}.$$

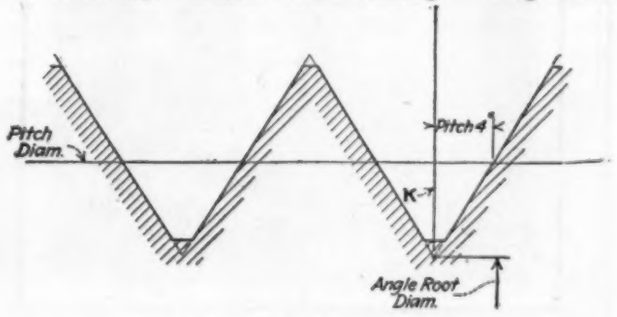
This amount K occurs on both sides of the axis of a thread plug from which we have the angle root diameter-pitch diameter—$2K$.

If we have W = diameter of wires used in measuring, then:

For 60-deg. threads: Wire reading = angle root diameter + 3 W and angle root diameter = pitch diameter — 0.866025 pitch.

For 55-deg. threads: Wire reading = angle root diameter + 3,16568 W and angle root diameter = pitch diameter — 0.960491 pitch.

For 29-deg. threads: Wire reading = angle root diameter + 4.9939 W and angle root diameter = pitch diameter — 1.93336 pitch.



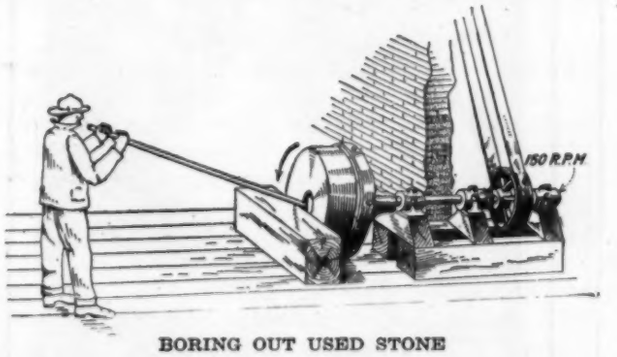
THREAD DIAGRAM

The convenience of these formulas, especially for 60-deg. threads, can be appreciated at a glance. The various constants for the different forms of threads with the same angle are eliminated, and possible errors due to outside diameter being slightly different from standard are avoided.

Conserving Worn-Out Grinding Stones

BY NORMAN V. CHRISTENSEN

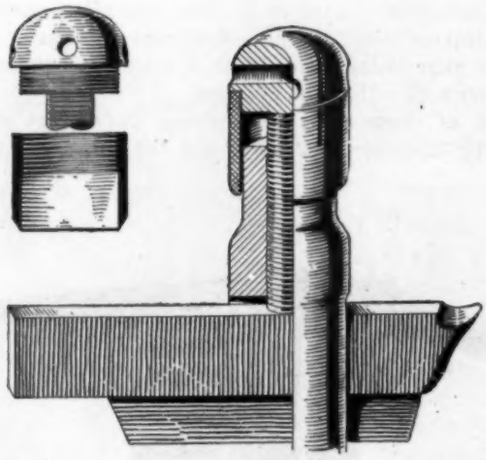
The sketch shows a method of utilizing old grindstone butts. Ordinarily, when quarried stones have done their duty on the periphery it is customary to pay laborers to break them up and haul the pieces away, but they may, without great expense, be made into serviceable facing stones by merely rounding out the holes to about 10 in. in diameter.

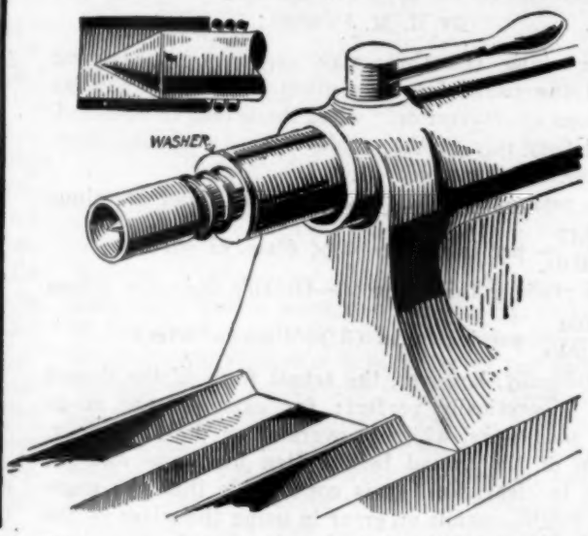


BORING OUT USED STONE

CURES *for* COMMON SHOP COMPLAINTS

By J. A. Lucas





Submarine Chasers Made by Quantity-Production Methods*

[Reprinted from *Engineering News-Record*]

The radical departure from all shipbuilding traditions at the Ford plant in building the "Eagle" submarine chasers has resulted in producing these boats on a manufacturing basis. Manufacturers in other lines may learn much from the methods pursued in the planning of this plant.

SHIP manufacturing instead of ship building, carried on under the roof of an enormous factory, is used for producing the "Eagle" submarine chasers at the new Ford plant on the River Rouge, near Detroit. Shipyard methods were largely discarded when the problem of immediately creating a great fleet of the large chasers had to be solved. The plant is now in regular operation, and the remarkable system of ship construction is a practical reality.

Most characteristic of the system is the fact that the shipbuilding berths are moved along to the material and the men instead of being stationary and having the men go to the berths. That this process of taking the work to the men, used in automobile assembling at the Ford shops, could be made to serve the needs of high-speed ship construction was the original conviction of Henry Ford when he undertook to build the fleet of chasers for the Government.

Every effort was bent toward obtaining the highest efficiency in applying the process. Direct straight-line movement of material was made a governing consideration when the factory was planned. A remarkable straight-line plant layout is the result. The "Eagle" plant lacks all resemblance to a shipyard, as may be seen from the interior view given in Fig. 1. What emphasizes the difference further is the absence of launching of the kind seen in shipyards. The completed hulls are lowered into the water by a huge elevator moved vertically by hydraulic jacks, shown in Fig. 2.

A remarkable ship design is an essential feature of the "Eagle" production. Pressed-steel shapes, electric welding and electric-rivet heating were called into service. From the design of the hull to the final equipment of the vessels the whole enterprise is a fabric of original thought. The plant, conceived as a means for most rapid construction of the chasers, as a quantity-production ship factory, represents a combination of bridge shop, automobile works and marine fitting-out yard.

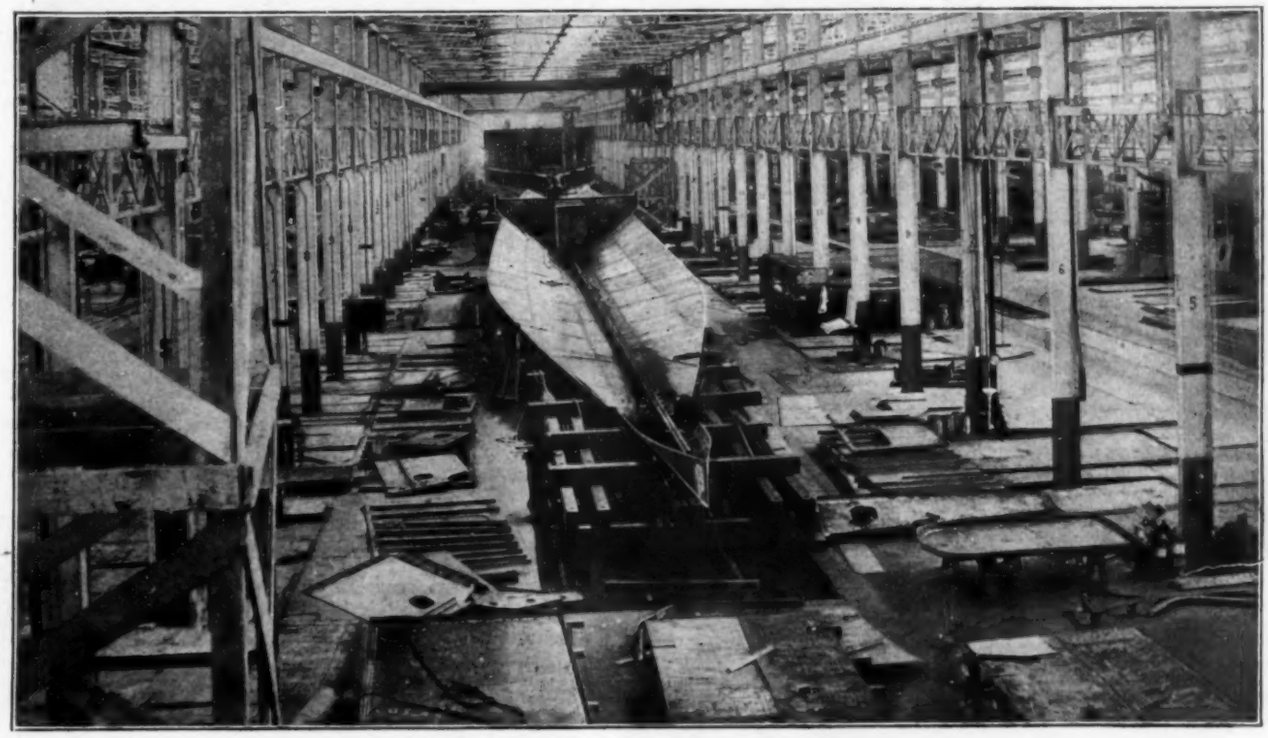


FIG. 1. INTERIOR VIEW OF PART OF THE ASSEMBLING SHOP

By the courtesy of the Navy Department in opening the plant to technical inspection and in supplying data concerning the work we are enabled to present a description of the perfected manufacturing process. Though this process is in every sense a special solution of a special problem, yet, being the product of technical genius, expert knowledge and manufacturing resource of a high order, it possesses a character that is likely to exert lasting influence on the entire art of shipbuilding.

[*This article has been passed by the Chief Censor of the Navy Department.]

Realizing the magnitude of the problem before it the Navy Department brought together a remarkable combination of men to work out a solution. Washington contributed Admiral D. W. Taylor and Capt. Robert Stocker, who designed the hull, and Admirals Griffin and Dyson and Commander S. M. Robinson, who designed the power plant. Secretary of the Navy Josephus Daniels contracted with the Ford Motor Co. to build the boats, and thereby brought into the work Henry Ford, systematizer of automobile manufacture, with his strong organization. Shipbuilding experience and craftsmanship were called in by drafting from the Manitowoc Shipbuilding Co. one of the most energetic shipbuilders on the Great Lakes, Charles C. West, to supervise the development of the hull-manufacturing systems. Commander Carlos Bean of the Navy was named to take charge as executive officer and to direct the practical development of the power plant, contributing executive ability and extensive torpedo-boat experience.

Through the planning ability and driving power of these men, aided by many others, the results were achieved of converting a paper-design into a successful factory-made ship and a prairie into an operative manufacturing plant within the short space of three months. Only a little later than this a working organization was in service despite the difficulty of obtaining skilled men.

In February the plans for the "Eagle" factory were started; late in May the first hull work was got under way. In July and August the first three "Eagles" were put into the water. Now the plant is in running order, has a working force of nearly three-fourths the ultimate intended strength, and each day is approaching the maximum rate of production.

In its completed form, as it now exists, the "Eagle" manufacturing system comprises the following elements: (1) A factory design of ship, prepared in its entirety by the Navy Department, a design which has straight lines substituted for curves as far as possible, in longitudinal lines as well as in cross-section and with the utmost simplicity and strength of structure; (2) multiple punching applied as extensively as possible; (3) preassembling or subassembling of parts that can be set in place as units; (4) erection of the ships in a long file moving forward to the material and to the workmen; (5) lateral short-distance movement of the hull materials from the storage piles to the ships; (6) step-by-step movement, the file advancing one station (the length of one hull) at fixed intervals (three to six days);

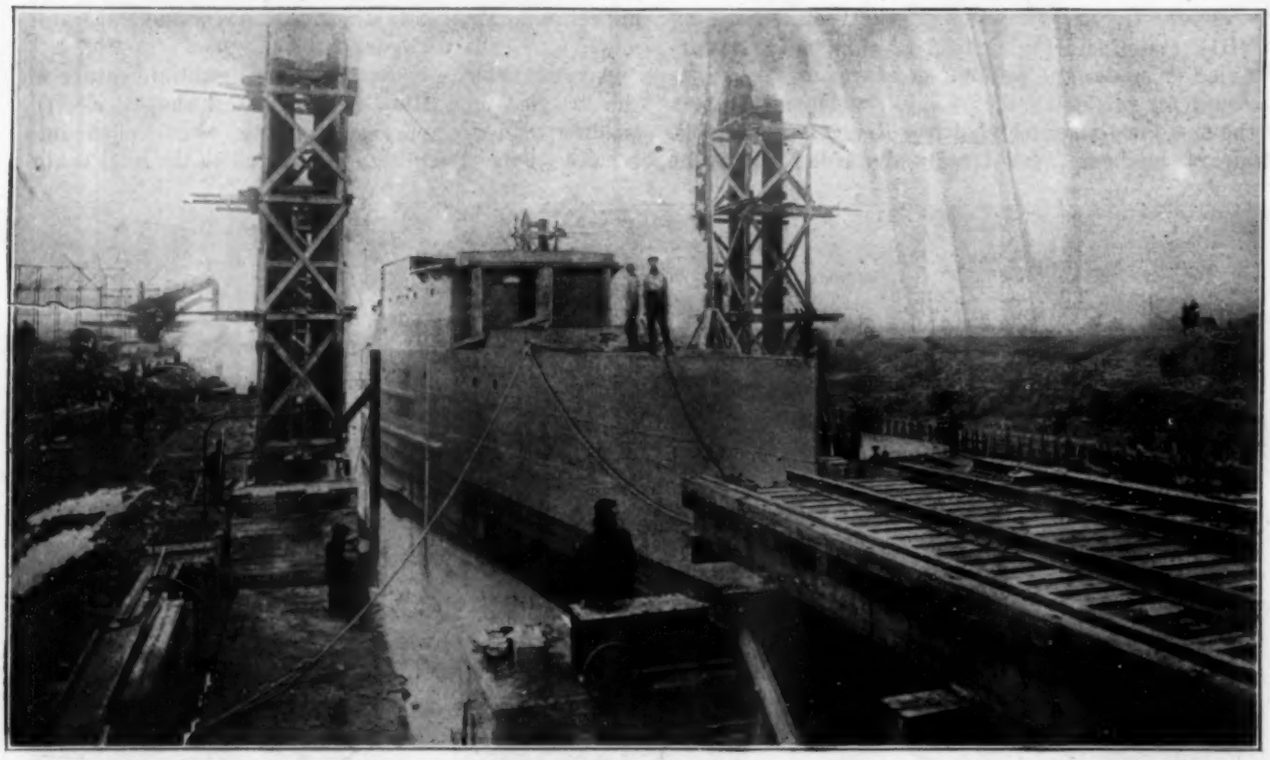


FIG. 2. METHOD OF LAUNCHING A FORD "EAGLE"

(7) arrangement of the work in three parallel competitive working lines; (8) railway-truck mounting of the hulls during erection; (9) transfer of the completed hulls into the water by a hydraulic elevator; (10) installation of interior fittings, machinery and other parts in step-by-step progressive movement of the ships along the fitting-out dock, by a series of stations like those of the hull erection, and with short-distance lateral movement of the material.

The two parts of the system—hull assembling and fitting out—together constitute a straight-line progressive shipbuilding mechanism, but are physically separated by the launching platform at the center of the plant. A straight-line plant arrangement serves for carrying out the straight-line process.

It does not appear that any one of these elements is vital to the success of the fundamental task of building the ships rapidly. However, taken together they today constitute an integral mechanism—the "Eagle" production system—and they are so interrelated that each one is essential to the successful working of that mechanism. This mechanism grew together gradually during the

evolution of the enterprise; its elements did not come into being as parts of one original conception.

The ship design itself underwent some changes during the working out of the manufacturing procedure. Thus, originally the side frames were 6-in. heavy-flanged channels, but when it was recognized that these might give trouble in beveling (required in the stern and bow sections) they were changed to flanged plates, following the design already adopted for the floors and brackets, as shown in Fig. 3. Furthermore the straking was changed so as to make as many as possible of the side and bottom plates parallel sided and rectangular to permit of the greatest possible extent of multiple punching (Fig. 4). Some other changes of minor character were made in the design. The important development

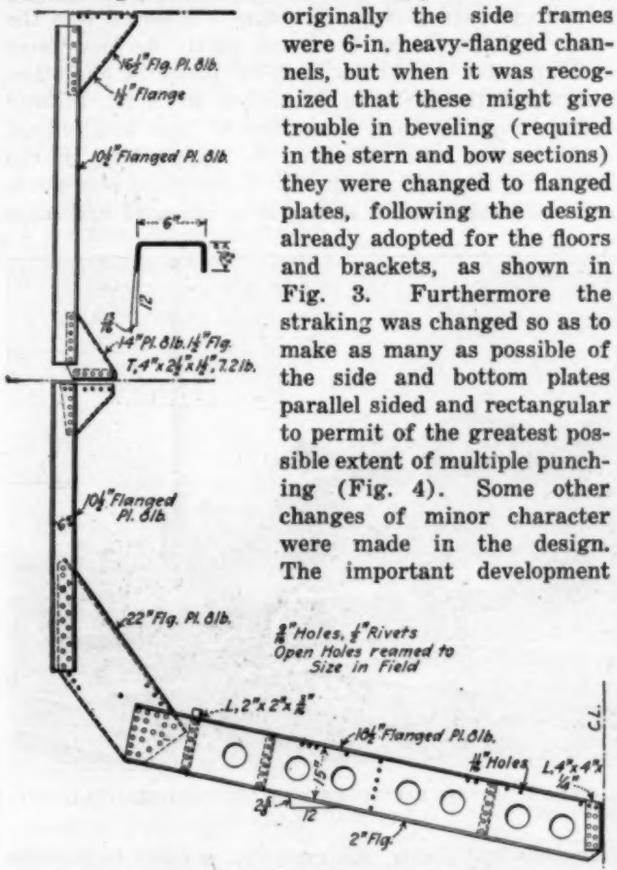


FIG. 3. SHOWING HOW FRAME IS BUILT UP OF STRAIGHT SECTIONS OF FLANGED PLATE

and change, however, were in the manufacturing system. Essential help in working out both the system and the design was obtained through the construction of a pattern ship in the Ford Automobile Works (Fig. 5) even before the ship plant had begun to take shape.

Taking the work to the material and men, the idea of the Ford automobile-assembling system, was at first intended to be applied by a conveyor-like arrangement, the ship moving along continuously at very slow speed. Though the Ford Co. was not experienced in shipbuilding, its successful development of automobile manufacture produced the conviction that the "Eagles" should be built under a roof and that the conveyor-assembling

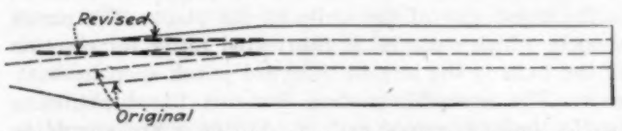


FIG. 4. WAY STRAKING WAS CHANGED TO INCREASE EASE OF PUNCHING

method was practicable and would result in great gain in time, cost and quality. In view of the novelty of its undertaking the company did not call upon either naval architects or shipbuilders to plan the factory operations. Getting the new enterprise started was, under these circumstances, like building a machine of a wholly new kind and making it an operating success, which, incidentally, describes accurately the task of developing the turbine power plant with which the ship is equipped.

Time for leisurely and careful development of plans was lacking under the urgent rush for earliest possible production. Prompt decisions and quick action were absolutely essential. The development, therefore, was a trying process to all concerned, and some steps were taken that conflicted with later decisions. For example, in order to get construction started the buildings had to be designed before all phases of the manufacturing process were elaborated, and it was found afterward that somewhat different arrangements in this or that detail would have been better. That an efficient ship-producing machine was created under these conditions and made ready for service in phenomenally short time testifies to the value of the combination of able men concentrated on the work.

In the development of the process study based on shipbuilding experience early indicated that continuous movement of the file of ships was not practicable, as the individual operations in the hull assembling are neces-

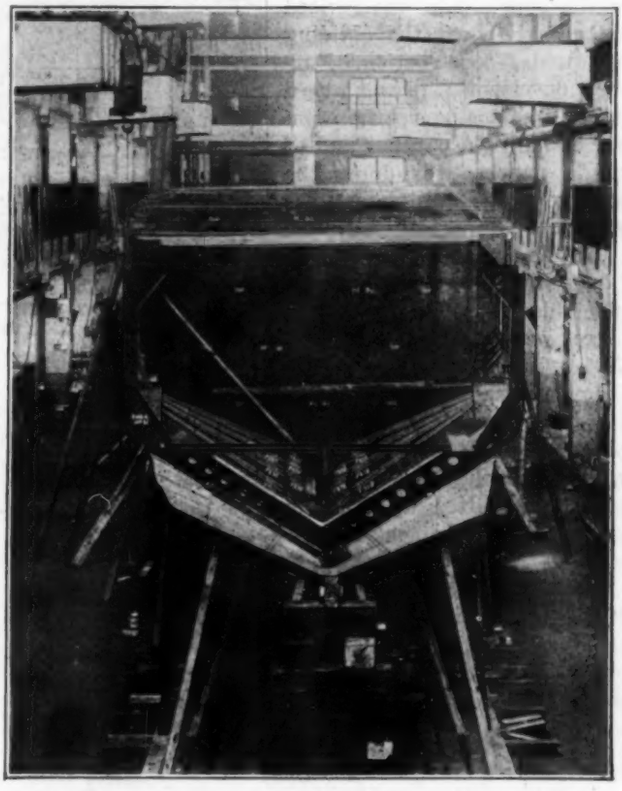


FIG. 5. PATTERN "EAGLE" BUILT TO HELP IN DEVELOPING SHOP DETAILS

sarily slow and involve large quantities of material. Step-by-step movement took its place, the string of hulls to be shifted forward one ship's length at a time. Seven stations were decided upon; this number was not dictated by inherent requirements of the ship-assembling process, but rather by the anticipated rate of working and the space conditions at the site. The three separate assembling buildings were joined into one, with a material-supply bay between and joining the assembling bays (line bays). Preassembling of parts then came to be recognized as an important agency of rapid working, and a length of about 200 ft. was added at the incoming end of the assembling shop for doing this work. The

progressive, or step-by-step, method was extended to the fitting-out work, since this half of the manufacture involves as much labor as the hull construction and brings into action even a greater number of trades. Finally, after the shop was already in service the order of assembling operations was fixed with regard to proper balance of time at the stations as determined by actual experience in the shop. For fabricating the hull material single punches were depended upon when the pattern ship was built. Later, machines were considered which would punch a group of holes at a time, the plate then to be shifted ahead by the length of a group. The example of bridge-shop practice prevailed, however, and multiple punching was adopted, using presses having a transverse gang of punches capable of being actuated simultaneously or in sets, and a rack for longitudinal spacing. The equipment plan of the punch shop was revised accordingly after the building was under construction. Further development occurred later in balancing up the number of multiple punches and of single punches for doing the work to which multiple punches were not particularly adapted.

An important contributory factor in the success of the plant development lay in the large resources of the Ford Motor Co. in machines and factory equipment. Thus the whole shop-crane installation of the River Rouge factory was brought together from Ford assembling plants all over the country, and the multiple punches which form the backbone of the fabricating end of the plant were fitted up from presses taken out of the sheet-metal department of the Highland Park automobile works.

Lying along the left bank of the widened and canalized River Rouge, some miles from Detroit, the plant extends in a straight line downstream, as shown diagrammatically in Fig. 6. Starting at the north end its successive parts are the plate-storage yards, the punch shop and, across a transverse road, the huge assembling shop,

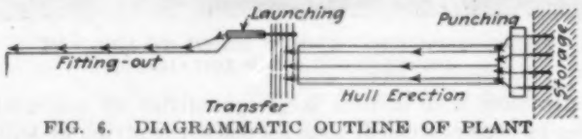


FIG. 6. DIAGRAMMATIC OUTLINE OF PLANT

which constitutes the main feature of the plant; just beyond this shop and a short distance to the right is the launching platform, to which the hulls are moved by a transfer table shown in Fig. 7. A few hundred feet downstream begins the concrete dock and ore-storage space of the Ford blast-furnace plant. On this dock has been erected a long, narrow fitting-out shed in two sections, each about 1000 ft. long, which holds the machinery and equipment for the finished hulls lying alongside the dock and moving forward in successive steps to receive different parts of the equipment. Supply warehouses that are located near by feed the fitting-out sheds.

Direct forward movement of material in the least number of separate moves characterizes the plant. From the storage yard plates and shapes are moved into the punch shop partly by hand and partly by locomotive crane and cars. After the marking, punching and other fabrication the material is loaded on short railway trucks moved by hand along one of four longitudinal tracks leading into and along the supply bays of the assembling shop. It goes directly to the place where it is to be assembled in the ship and is unloaded and piled

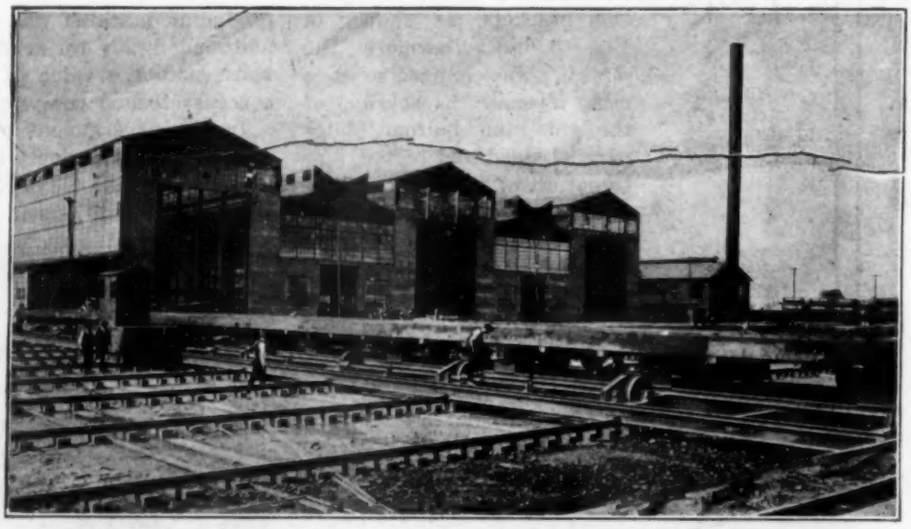


FIG. 7. GREAT TRANSFER TABLE WHICH RECEIVES THE ASSEMBLED HULL AND DELIVERS IT TO THE LAUNCHING PLATFORM

alongside that point. An exception is made in the case of material for preassembled parts, such as frames, deck sections, bulkheads and the like, which is unloaded at the head of the assembling shop and is bolted up and riveted there. The completed parts are then moved down the shop to the proper station by bridge cranes spanning the assembling bays.

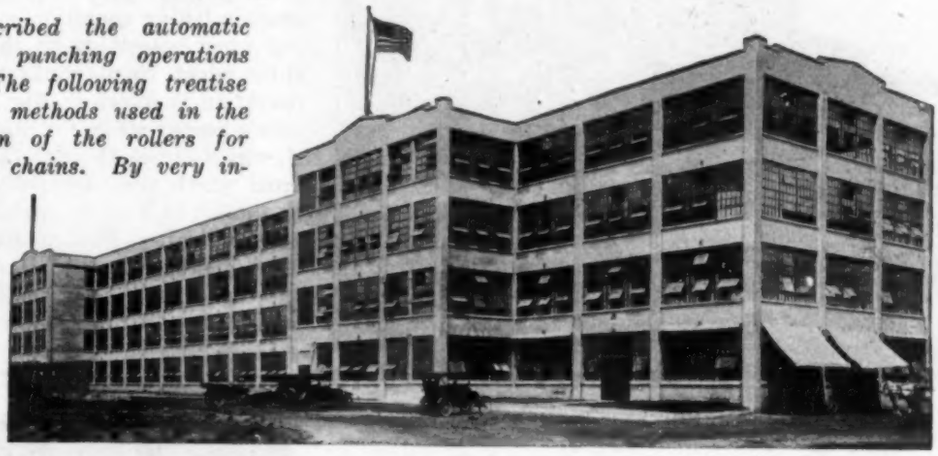
Thus the material and supplies, having once reached the punch shop or the warehouses, undergo in general but a single move to a point directly adjacent to the place of assembling in the ship. From there a short cross-transfer only is required to put them in final position.

Building up a working mechanism for carrying out this revolutionary process of ship construction was done with equal originality and disregard of precedent. Fully as impressive as the boldness of the designers, however, is the great size of the units of the plant. The punch shop in which material is fabricated ready for erection in the hulls is the largest shipyard punch shop in existence. The assembling shop contains 21 shipbuilding berths under one roof and in addition a preassembling space that in itself is as large as many bridge shops. The launching platform, conceived by W. B. Mayo, chief engineer of the Ford Motor Co., is the equivalent of a 200-ft. railroad bridge mounted on hydraulic jack supports capable of moving it up and down through a range of 20 ft. Of the same magnitude and difficulty was the task of providing for boiler and turbine manufacture after the development problems of the power plant had been worked out.

The Manufacture of Diamond Transmission Chain

By J. V. HUNTER, Western Editor *American Machinist*

A previous article described the automatic machinery used for the punching operations in making side links. The following treatise will describe the various methods used in the production and inspection of the rollers for heavy and light types of chains. By very ingenious arrangements a large amount of the inspection is performed by semi-automatic machines.



Part II. Making Rollers

THE first transmission chains used in the bicycle days had solid-block connecting links between the side links. This type of chain was followed by the roller chain, which in its general design is considered by many to be more efficient than the earlier type. Years ago when the Diamond Chain and Manufacturing Co. of Indianapolis took up the manufacture of the roller type of chain the management proceeded to develop automatic machinery in order to produce high-grade rollers in the most efficient manner.

It has several means of producing these rollers, depending entirely upon their size and the service they are to render. The lighter rollers are formed out of dead-soft rolled strip steel stock; the larger ones are turned out of cold-rolled bar stock in the automatic-machine department which contains about 400 automatic screw machines. If we consider first the automatic machines which have been developed for the formation of rollers from flat bar strip we will find in Fig. 14 a view of one of the machines which are used for this purpose. This machine is a four-slide wire-forming one, which has been arranged with certain automatic devices to fit it for the special work which it is called upon to perform.

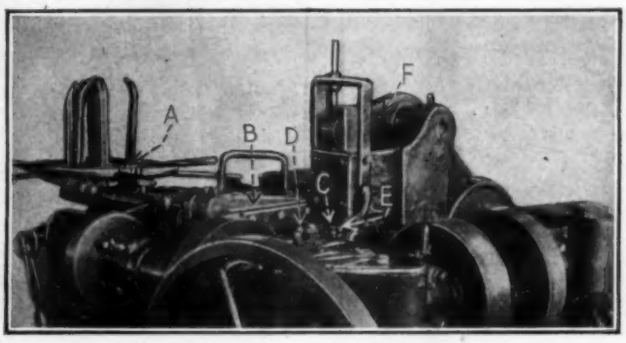


FIG. 14. ROLLER-FORMING MACHINE SHOWING OPERATING PARTS

In the rear at *A* will be seen the reel for coil of strip steel from which the rollers are formed. These strips are of different widths, depending upon the length of the finished roller. As this strip is fed into the machine, about at *B*, a special automatic cutter cuts off the stock the correct length for the circumference of the roller. By a peculiar arrangement this cut is made at the correct angle so that the two ends when brought together form a tight joint on both the inside and outside circumferences. These ends are so tightly pressed together during the process of forming the roller that the joint can hardly be detected without the use of a magnifying glass.

When the piece of stock is cut off by the shear previously mentioned it is pushed forward to a position at *C*, where it comes in front of a mandrel equal in size to the inside dimension of the roller. The plunger *D* pushes the piece forward against the mandrel and forms it into a U-shape, holding it against the mandrel while another plunger *E* comes from the rear and brings the ends together completing the formation of the circle. Immediately the mandrel *C* descends in a vertical direction, being controlled by the lever *F*, and drives the formed-up roller through a round die below. This operation insures the practical closing of the joint, the exact sizing for outside diameter, and has a cold drawing action which brings the roller to the proper shape and size. In order to obtain the best results this dead-soft strip must be fed to the machine in an absolutely straight condition, and because it is so soft there is always a tendency for it to become kinked during shipment. In order to remove these kinks entirely before the material enters the machine the roller-straightening devices shown at *A*, Fig. 15, are provided for both the vertical and lateral straightening of the strip. A supply of cutting compound is kept constantly flowing over the forming dies, the supply pipe for this lubricant being shown at *B* and the drainage and supply tank at *C*. The completed rollers as they are forced through the dies slide down the chute *D* into the receptacle at the right.

A tool which is used throughout the shops in all the machines is the magnet with the wooden handle shown at *E*, which is similar in appearance to the screwdriver seen at its left. This magnet is a useful device as it permits the operator to quickly remove any small parts

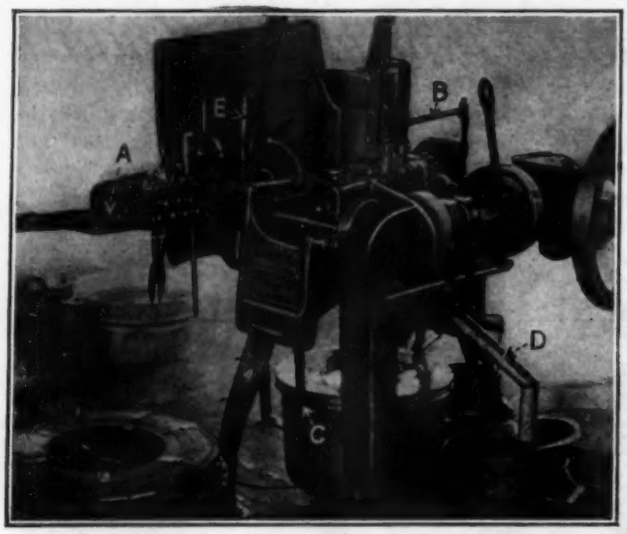


FIG. 15. STRIP-STRAIGHTENING DEVICE ON ROLLER MACHINE

or scraps of metal which may fall between the moving parts of the machines; besides being expeditious it eliminates danger of accident to the operator's fingers.

An automatic machine which is used for making a slight countersunk cut to remove the bur from the inside of the rollers is shown in Fig. 16. The rollers are poured into the hopper *A*, which by an up-and-down jolting motion feeds them into the magazine tube *B*. A feeding ram actuated by cams feeds the rollers one at a time between the countersinking drills *C*. Another cam then brings these drills together the requisite amount for removing the bur. The roller is then released and rolls down the wire chute into the bin below. While passing over this chute the chips fall through the wire mesh into the chip receptacle *D*.

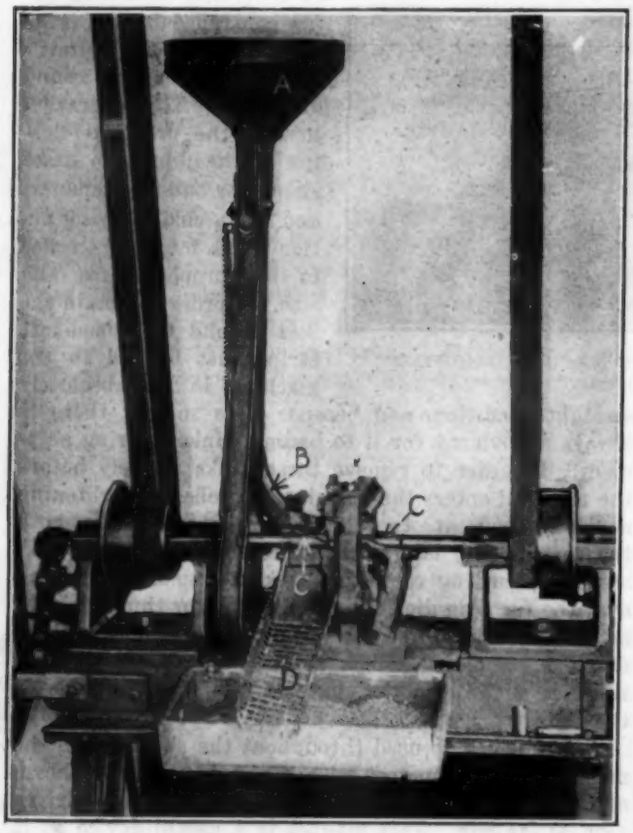


FIG. 16. DEVICE FOR REMOVAL OF BURS FROM LARGE BUSHINGS

All blocks, rollers and bushings are subjected to a countersinking operation so that there may be no binding when assembled on the pins. An automatic machine which countersinks two rollers in each cycle of operation is shown in Fig. 17. The rollers are poured into a hopper above the machine and jolted by the lever *A*, which causes them to fall into the magazine tube *B*, from which they are fed into the conveyor *C*, which is similar to a large sprocket wheel, and receives two rollers between two of its sprockets. This revolves, carrying the rollers forward to the positions *D*, where the clamping lever *E* comes down on them and firmly holds them while the countersinks carried on the spindles *F* advance and enter the holes. On the withdrawal of the countersinks suitable cam arrangements cause a partial revolution of the conveyor, bringing another pair of rollers in line with the countersinks and the cycle is repeated.

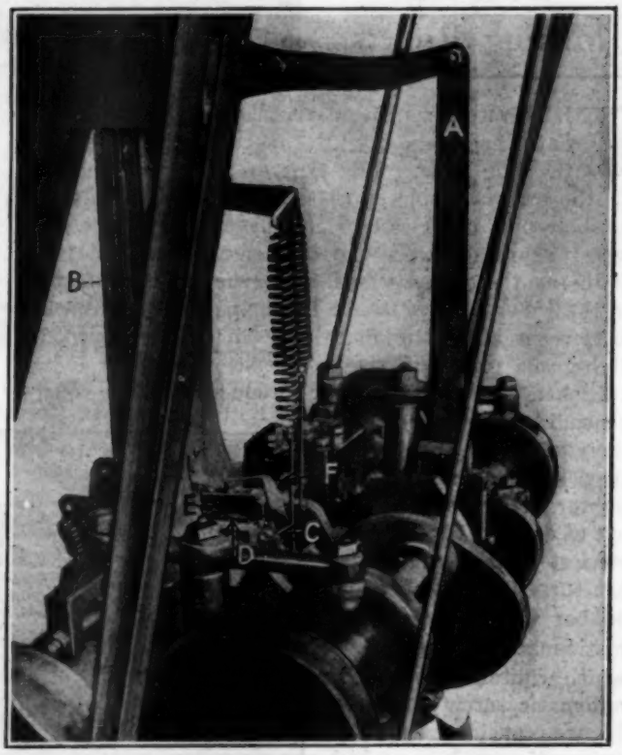


FIG. 17. DOUBLE COUNTERSINKING DEVICE FOR TWO BUSHINGS

Inspection of Rollers

The manual labor necessary for the inspection of the vast quantity of rollers produced by the automatic machines is avoided to a large extent by the employment of mechanical devices. Fig. 18 is a machine for gaging the outside diameter of the rollers used in bicycle and other small roller chains. The rollers are dumped into the hopper *A*, the bottom of which consists of a steel plate *B* rapidly revolving and which may be seen resting on a ball-bearing ring *C*. The natural tendency of this revolving plate is to throw the rollers against

the outside rim by centrifugal force. Scrapers on the inside turn all the rollers so as to lie flat on their ends. The lower edge of the hopper in contact with the revolving plate consists of a hardened-steel ring in which slots *D* of the required diameter for the rollers have been cut and ground with great accuracy.

The centrifugal action drives all rollers of the required diameter through these slots and thus gaging

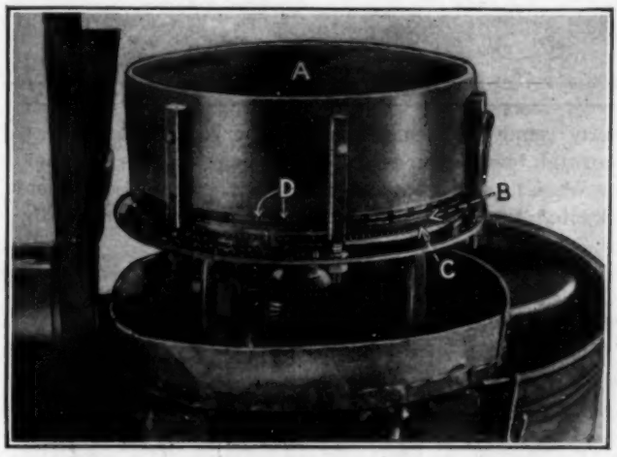


FIG. 18. GAGING DEVICE FOR DIAMETER OF ROLLERS

of the diameter occurs with great rapidity until the slots become clogged with oversized rollers, when the operator removes them with a bar magnet. At the end of the operation, nothing but oversized rollers will remain in the hopper.

The next operation is to gage the rollers for length, and, like the preceding machine, the device used for this purpose can only be employed on rollers the length of which is less than their diameter. The gaging device is shown in Fig. 19.

One of the essential members of this machine is the

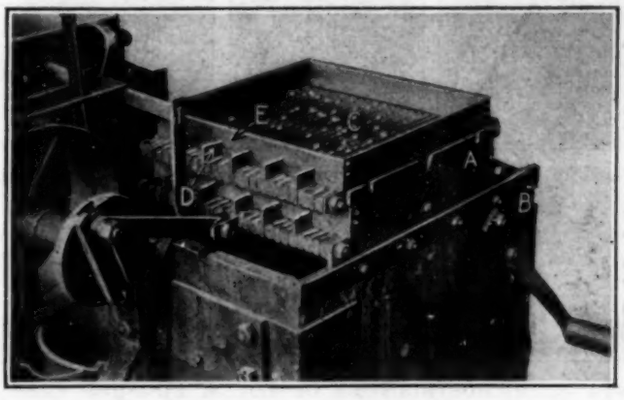


FIG. 19. SCREENING DEVICE FOR GAGING LENGTHS OF ROLLERS

reciprocating frame *A*, which slides on the base *B* and is actuated by means of a belt-driven eccentric. On this reciprocating frame is placed the screening device *C*, which consists of hardened and ground beveled-edge bars accurately spaced for the correct length of rollers by means of small steel blocks *D* inserted between their ends outside of the frame *E*. The rollers are thrown loosely into this frame and the reciprocating action of the device soon jiggles through all that are under the

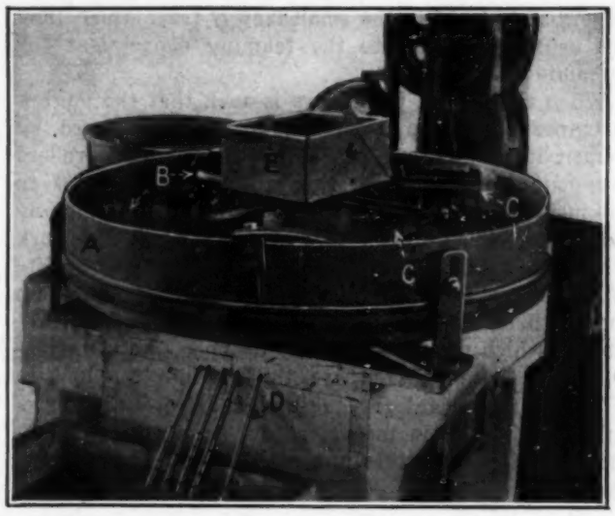


FIG. 20. DEVICE FOR GAGING INSIDE DIAMETERS OF ROLLERS AND BUSHINGS

maximum length. The screening devices *C* are built interchangeably and graduated for the different lengths of rollers to be gaged.

There is one other gaging operation to be performed, which is done by the device shown in Fig. 20, which gages the interior diameter of the rollers in a rapid and efficient manner. The circular pan *A* is revolved at the rate of about twenty revolutions per minute. In this pan are placed the rollers to be gaged. On the four cross-arms *B* are held down by dowel pins the five tined forks *C* more clearly shown at *D*. The diameter of these tines is the minimum diameter allowable for the inside of the rollers.

The revolution of the pan carries the rollers against the pointed tines of the forks, and as the ends come into the proper position the rollers rapidly slip up onto the tines until all on the forks are filled. When a roller of too small an inside diameter comes in contact with a tine point its tightness prevents it from sliding up, so that either the tine remains partially filled or the tight roller does not readily slide off when the operator removes the fork from the machine and holds it over the bin in which all graduated rollers are dumped. Undersized parts are pulled off with the

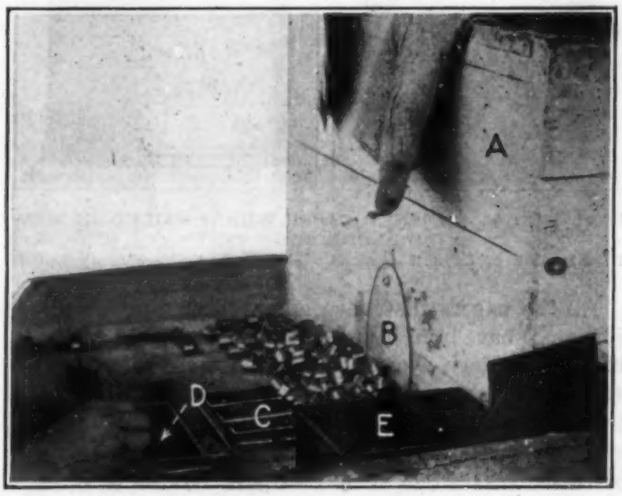


FIG. 21. WOMAN INSPECTOR GAGING WITH BOTH HANDS

fingers and placed in the small tray *E* from which they are usually returned to the reaming department for rereaming.

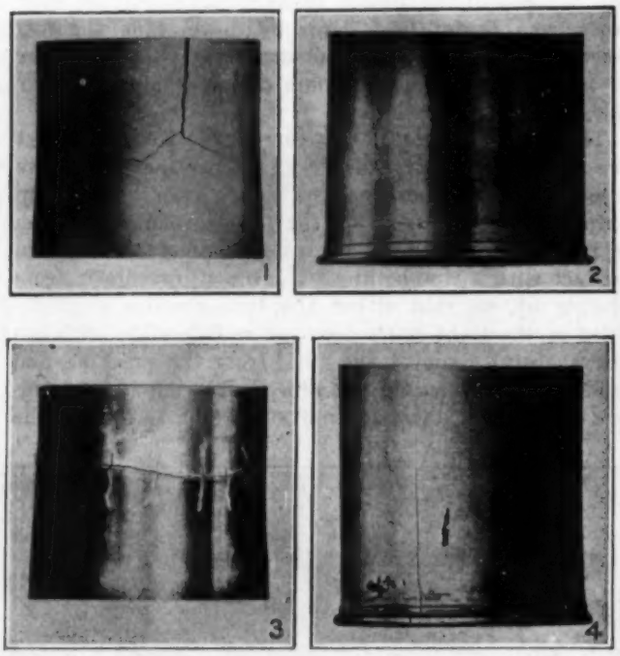
When the size of the rollers is such that the gaging machines cannot be used, the work is performed by women inspectors, as shown in Fig. 21. The rollers are poured in bulk into the bin *A* and feed out to the inspector through the small trapdoor *B* immediately before her. These inspectors are very adept and work with both hands simultaneously. The gage *C* is a plate of the "pass" and "not pass" type, and is double so that both hands are used in gaging at the same time. Rollers which pass the gage are dropped into the chute *D*, while those rejected are thrown into the box *E*.

This arrangement for gaging indicates a very careful investigation in motion study, as the hand movements of the inspectors approach the minimum which can be conceived for performing this work.

The Prevention of Season and Corrosion Cracks*

By W. B. Price

The most scientific and lucid explanation of season and corrosion cracking ever published was the 1914 May lecture on "Internal Strains in Cold-Wrought Metals and Some Troubles Caused Thereby," by Prof. E. Heyn, presented before the British Institute of Metals.



FIGS. 1 TO 4. FINISHED CASES WHICH FAILED IN MERCURIC-CHLORIDE TEST
Fig. 1—Lot A. Fig. 2—Lot B. Fig. 3—Lot C. Fig. 4—Lot D

All the papers that have appeared on the same subject since have been based on Heyn's original paper. In his article Heyn showed that when a cold-drawn brass rod of the composition copper 57.8 per cent., zinc 40.8 per cent. and lead 1.35 per cent. was subjected to a special heat treatment at temperatures varying from 100 to 230 deg. C., the reheating gradually relieved the internal strains, and that this effect became apparent much below the temperature at which the effect of cold working (increase in tensile strength, increase in elastic limit and decrease in elongation) was perfectly removed. "Specimens of the rod reheated for 3 hours at temperatures below 100 deg. C. showed cracking when dipped in mercury solution, whereas specimens reheated 3 hours at 100 deg. C. and more stood the dipping test without cracking."

TABLE I. RESULTS OF MERCURIC-CHLORIDE TESTS ON FINISHED CASES, NOT HEAT-TREATED

Lot	Number Tested	Number Failed	Character of Failure
A	4	1	Crack on mouth. See Fig. 1, Plate I.
B	4	2	Transverse crack on mouth and base. See Fig. 2, Plate I.
C	4	1	Transverse crack on mouth. See Fig. 3, Plate II.
D	4	1	Longitudinal crack through flange. See Fig. 4, Plate II.

The object of this paper is to record my experience in applying the heat treatment recommended by Heyn to four lots of finished 75-mm. cases, which had cracked at the mouth and base when subjected to the Government test of immersion for a period of 4 hours in a 1.5 per cent. solution of mercury bichloride (corrosive sublimate).

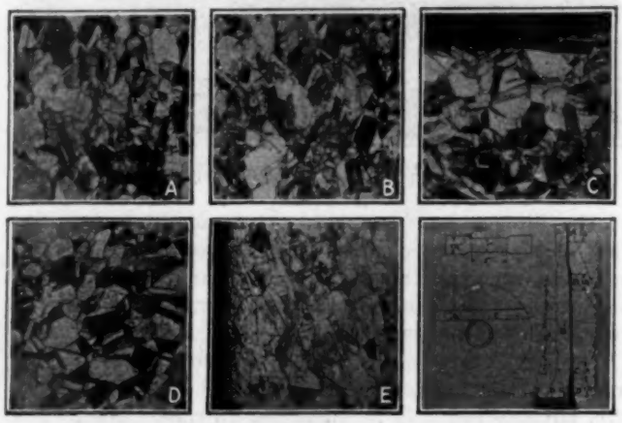


FIG. 5. MICROSTRUCTURE OF LOT A. FINISHED CASE NOT HEAT-TREATED. ETCH, $NH_4OH + H_2O_2$

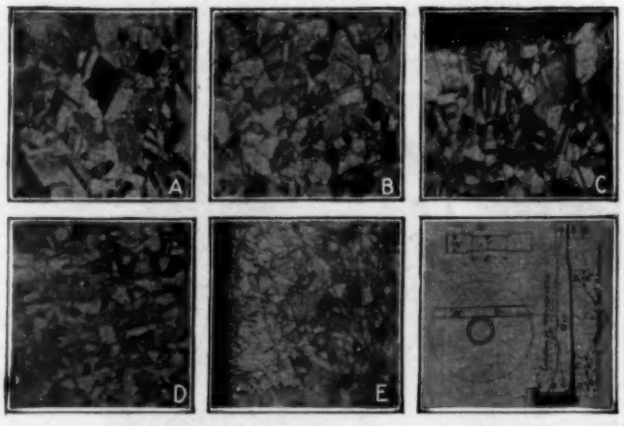


FIG. 6. MICROSTRUCTURE OF LOT A. FINISHED CASE HEAT-TREATED 3 HOURS AT 500 DEG. F. ETCH, $NH_4OH + H_2O_2$

The results of the tests before heat treatment given in Table I, Figs. 1 to 4, illustrate the character of cracks which had developed on various lots of finished

*Paper read at the meeting of the American Society for Testing Materials, Atlantic City, N. J., June 25-28, 1918, by W. B. Price, chief chemist and metallurgist of the Scovill Manufacturing Co., Waterbury, Conn.

cases after they had been subjected to the mercuric-chloride test.

A number of shells from each of the four lots were heat-treated for periods of one, two and three hours at a temperature of 500 deg. F. (260 deg. C.) in a Simplex electric oven equipped with a Bristol recording thermometer. The shells to be heat-treated were placed in the hot furnace, which was at 500 deg. F. when empty, and after a preheating period of a half hour the thermometer read 500 deg. F. Some of the shells were removed at the end of the first, second and third hours of heat treatment. The temperature fell about 60 deg. F. whenever the furnace door was opened to remove a batch. In no case, however, did the temperature exceed the desired temperature more than 15 deg. F.

Physical tests were made on two cases without heat

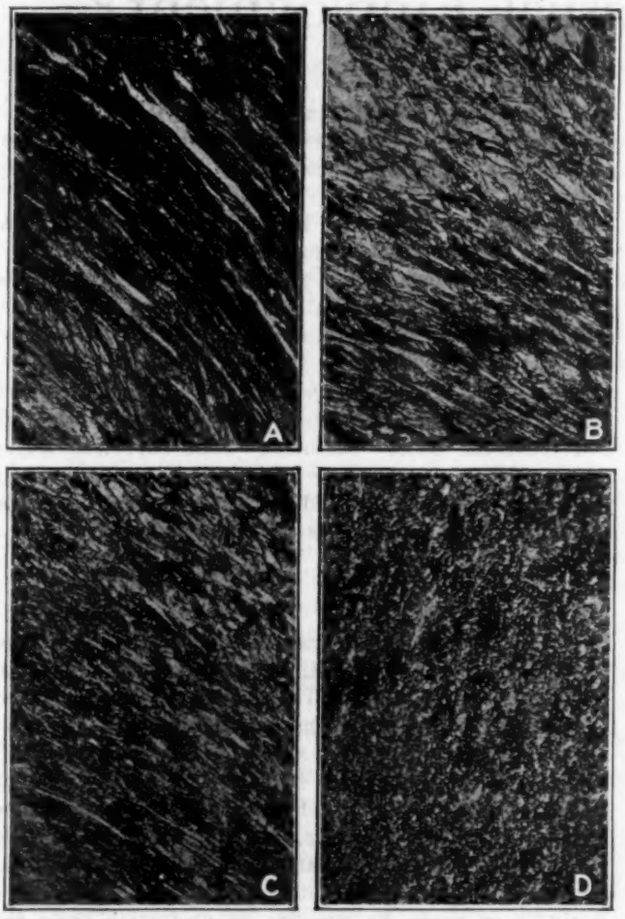


FIG. 7. MICROSTRUCTURE OF FLANGE LOT A MAG. 75 × ETCH, $NH_4OH + H_2O_2$ — A NOT HEAT-TREATED, B HEAT-TREATED 1 HOUR AT 500 DEG. F., C HEAT-TREATED 2 HOURS AT 500 DEG. F., D HEAT-TREATED 3 HOURS AT 500 DEG. F.

treatment and on three heat-treated cases, taken from lots A, B and D, with the results given in Table II.

It is very evident from these figures that the heat treatment has apparently not affected the actual physical properties of these cases as measured by the ordinary testing machine. A temperature as low as 500 deg. F. is not sufficient to affect recrystallization on the greater portion of the shell as manufactured here. Nevertheless, heat treating has certainly diminished the degree of internal strains. Not one of the 12 cases which were tested from each of the four lots, as heat-treated, failed in the mercuric-chloride test. Furthermore it is certain that the heat treatment has left the cases in a condition to resist corrosion or season crack-

TABLE II.—PHYSICAL TESTS

Description	Location of Section	Tensile Strength, Lb. per Sq.In.	Elongation in 2 In., Per Cent.
Lot A			
Finished case not heat-treated: Case 1...	A	52,638	42.8
	B	63,296	23.0
	C	67,200	18.5
	D	62,333	23.2
	E	63,558	22.5a
Finished case not heat-treated: Case 2...	A	56,338	43.2
	B	70,723	16.0
	C	74,228	15.8
	D	69,304	17.3
	E	61,326	9.0a
Finished case heat-treated 1 hr. at 500°F.	A	53,663	44.5
	B	64,212	20.5
	C	66,375	16.7
	D	65,053	21.3
	E	63,562	8.5a
Finished case heat-treated 2 hr. at 500°F.	A	57,010	35.7
	B	68,854	17.8
	C	72,256	15.0
	D	66,425	14.5
	E	62,931	6.0a
Finished case heat-treated 3 hr. at 500°F	A	55,985	32.5
	B	65,508	22.7
	C	64,778	24.3
	D	67,027	22.3
	E	62,176	21.5a
Lot B			
Finished case not heat-treated: Case 1...	A	55,145	45.5
	B	70,877	17.0
	C	74,436	13.2
	D	70,252	16.7
	E	64,341	15.2a
Finished case not heat-treated: Case 2...	A	52,898	42.7
	B	60,361	27.5
	C	64,498	18.8
	D	61,154	19.2
	E	63,055	9.0a
Finished case heat-treated 1 hr. at 500°F.	A	54,904	37.8
	B	64,802	21.2
	C	69,177	15.8
	D	67,031	18.5
	E	64,942	14.0a
Finished case heat-treated 2 hr. at 500°F.	A	55,469	39.3
	B	66,247	20.0
	C	68,347	17.3
	D	65,890	20.8
	E	63,582	14.5a
Finished case heat-treated 3 hr. at 500° F.	A	50,963	31.0
	B	58,671	27.0
	C	59,899	27.7
	D	58,787	26.2
	E	58,159	39.0a

a Elongation in 1 in.

Lot D			
Finished case not heat-treated: Case 1...	A	55,920	34.3
	B	69,435	18.0
	C	84,657	11.8
	D	70,575	13.8
	E	67,325	18.0a
Finished case not heat-treated: Case 2...	A	54,445	30.8
	B	65,937	18.5
	C	81,061	13.2
	D	69,982	17.0
	E	67,156	19.0a
Finished case heat-treated 1 hr. at 500°F.	A	54,857	36.8
	B	70,759	15.8
	C	86,893	8.3
	D	71,378	14.0
	E	65,296	21.5a
Finished case heat-treated 2 hr. at 500°F.	A	55,437	18.0
	B	69,118	16.7
	C	83,828	11.2
	D	70,256	12.3
	E	67,770	18.5a
Finished case heat-treated 3 hr. at 500°F.	A	55,797	15.8
	B	68,115	14.8
	C	83,414	4.8
	D	72,584	13.0
	E	68,496	14.0a

a Elongation in 1 in.

ing on the ballistic test and on long standing. In fact it is very probable that this heat treatment has even increased the tensile strength several thousand pounds per square inch. Mathewson and Phillips have shown that heat treatment below the point of recrystallization

actually increases the tensile strength of hard-rolled brass.

The heat treatment has not affected the microstructure on the sections as taken according to the United States Government specifications. This is illustrated by Figs. 5 and 6. However, a slight recrystallization has taken place near the flange and at a section of the head about ½ in. from the primer hole, as shown in Fig. 7, after the 2 and 3 hour heat treatments, but does not show it after the 1-hour treatment. This condition is to be expected, because these sections represent the places where the case receives the most work. Recrystallization is a function of the temperature and degree of reduction by working, or as Mathewson and Phillips so ably express it: "In order that the heat-treatment effect may be felt at a given temperature it is clear that the mechanical destruction of the original grain must be sufficiently pronounced to produce fragments inferior in size to the recrystallized grain characteristics of this temperature." Although it is true that recrystallization of these particular places has lowered the tensile strength somewhat this is offset by the fact that internal strains in these areas have been positively reduced, if not entirely eliminated from the metal.

It is to be noted that a heat treatment of 500 deg. F. for one hour does not effect a recrystallization even on the hardest portion of the shell and yet is sufficient to relieve all internal strains and prevent the case from cracking in the mercuric-chloride test.

What Constitutes Casual Employment?

By CHESLA C. SHERLOCK

The question of casual employment within the meaning of the compensation acts is one in which all employers are vitally interested. What constitutes such employment has been so variedly interpreted by the courts in different states that it is difficult for the average employer to comprehend the limits of his liability.

IT IS generally understood that an employer is liable for the payment of compensation when an employee receives an injury arising out of and in the course of his employment. The compensation acts have specifically provided that an employer shall not be liable for the payment of compensation to a casual employee, regardless of the manner in which such employee was injured.

While it is comparatively easy to show definitely why compensation should be paid to employees and to determine who are employees it is an entirely different matter to determine just who are casual employees. Even the highest courts have had no small amount of trouble in solving the problem and we find several of them arriving at entirely different decisions.

The Ohio Industrial Commission has given the following definition: "The word 'casual' is from the Latin 'casualis,' which means coming 'within regularity;' 'happening within regularity;' 'happening or coming to pass without design and without being foreseen or expected.'" The Montana act defines the term "casual," for that state: "Casual employment means employment not in the usual course of trade, business, profession or occupation of the employer."

In a Massachusetts case it was held that "its meaning may be more clearly understood by referring to its antonyms, which are "regular,' 'systematic,' 'periodic' and 'certain.'"

In Connecticut the court said: "Casual employment means occasional or incidental employment; an employment which comes without regularity." The court added that "no hard and fast definition of the term is advisable."

In New Jersey the court held that "the mere fact that a workman undertakes the work without any express agreement as to the amount which he shall be paid is not sufficient to constitute him a casual employee."

In another case it was held that piecework is not sufficient to show casual employment.

In a Massachusetts case the court decided that "employment for one day is not casual where a person was employed as a driver for the delivery of brick not for one particular job but for the day only."

The use of the term "casual employment" results from our adoption of the compensation acts of England and from the usual "doctoring" that borrowed legislation must suffer in our own legislative halls. In England, however, they had worked out a very definite meaning for the term "casual employment."

Little Aid from the English Law

Practically every one of our compensation acts contain some reference to casual employment, but the wording has been so mutilated that we can look to England for little aid. The American compensation acts were, as stated by the Iowa Industrial Commissioner, "the product of the shears rather than the pen."

In one of our states we find that casual employment refers only to that work which is not within the scope of the employer's business, trade or occupation. No matter how long a workman may be employed or what are his duties, if he is not engaged in the employer's business or trade, he receives no protection from the compensation acts, but is considered a casual employee.

In other states the wording has been so changed that the courts have said that if a workman is engaged in the employer's business or trade, no matter how incidental his work may be, he is not a casual employee, but entitled to the benefits of compensation in case of injury.

This would mean that in order for a workman to be held a casual employee he must not only be employed in work which is casual, but which is also not in the usual course of the trade, business, profession or occupation of the employer.

There can be no doubt but that it was the intention of the legislative authorities enacting these laws to

exclude casual employees from the benefits thereof when they were clearly engaged in such employment. And the term "casual employment," such as to deny recovery, should include work in the employer's trade or business as well as that outside it if the true spirit of the compensation acts is to be maintained.

In England the test applied to determine the nature of a contract of employment is not the terms of the contract itself so much as the nature of the actual service rendered. They look more to what the workman was doing at the time of his injury and then proceed to adjudicate the case.

The Massachusetts court has said that the test in this country should be the contract of service and not the nature of the work done at the time of the injury. While this is followed in many jurisdictions it will be found more and more that the tendency of the courts and commissions is to ask what the injured man was doing at the time of the accident.

Both Tests Should Be Applied

It seems that justice is more consistently met by applying not the one test or the other, but by applying both where possible. The contract of service, of course, should indicate the nature of the work it is intended the employee shall perform, but in our industrial life we often find that once an employee enters in the service of another, conditions may remove him entirely from the work originally contemplated and compel him to perform different and perhaps more dangerous tasks.

We should use the contract of service for what it is worth, but we should inquire into the nature of the work that was being done at the time of the injury, as in many instances it will solve the matter.

The California Commission has adopted the arbitrary rule that any employment which runs for more than one week is not casual. If this is true then any employment for a term less than one week could be considered as being casual. While this view of the situation might obtain in California it would not be safe to adopt it as a general rule, as one of the Eastern courts held that employment for the period of one day only was not casual.

Period of Employment Not Only Consideration

The point of time is generally a poor measure to use in determining the status of an employee, so far as casual employment is concerned. Of course employment which extends over a long period is conceded not to be casual, because it continues with regularity, but when we get down to the question of whether the dividing line stands at one week or one day or perhaps a few hours we are treading on dangerous ground and inviting no end of difficulty.

One of the English authorities has suggested a test which seems to be the best that has been offered. It is as follows: "If, by the agreement between the employer and workman, the workman undertakes to work for the employer at fixed times or for definite periods separated by intervals (i.e., if the workman has the right to come to work at those times without being specifically engaged from time to time), the employment is not casual. If, on the other hand, the employment ceases at the end of each period of work, in the sense that the workman would not have the right and would not be expected again to work for the employer without a fresh engagement, the employment is casual. But where the work is more or less regular, although separated by intervals, the employer ought not, and probably will not, be allowed to escape liability by adopting a system of hourly or daily engagements."

Conditions Differ in Different States

While this test seems to be fair no matter to what specific statute it may be applied it would be inadequate in some of our states. It makes no reference as to whether the workman was engaged in the employer's trade or business or in outside work. The inference, however, would be that the test was written with the employer's trade or business in mind. It is rather disconcerting to have the courts say that we must look to the contract of service as the true test when the legislative authorities have said that work performed in the course of the employer's trade or business, no matter how casual it may be in fact, is not to be considered casual.

If we are to look always to the contract of service more substantial justice may be done in a few cases, but it is apt to do injustice oftener. On the other hand to look to the nature of the work is manifestly unfair in many cases. For instance, a workman had been employed in nonhazardous employment in a factory. One day his foreman ordered him to help out in another part of the factory at work that was hazardous, especially so because he had no expert knowledge of the operation of the machinery that he was to use in that casual work. But the court looked to the nature of the work that the injured man was doing at the time of the injury and held that he was engaged in casual employment because he was outside the scope of his employment at the time of the injury and denied him any compensation. This test proved a boomerang which rebounded to the loss of the employee.

The Emergency Rule

It was this identical class of cases which had a great deal to do with the establishment of the rule in compensation cases known as the "emergency rule." While this rule arose from unforeseen accidents occurring outside the workman's employment which caused him to go outside the employment to perform some act, in the pursuance of which he was injured, the courts are commencing to apply it also to emergencies in the course of the employer's business which require the shifting of labor from one occupation to another.

The uncertainty among the authorities as to what constitutes casual employment is shown by some of the decisions that have been handed down tending to illustrate the definitions mentioned earlier in this discussion, but more often the tendency of these decisions has been only to add obscurity to the issue.

The conflict in respect to time has already been mentioned, but it is no more noticeable than that of the nature of the work being done. For instance, washing windows of a factory building has been held to be casual employment, while the same service employed on an office building has been held not to be casual employment. Other courts have said that window washing, no matter where the service was rendered, was casual.

In like degree scrubbing floors or woodwork would come under the same conditions and restrictions. Other jurisdictions have gone so far as to inquire who the employer was, holding that an employee of a municipal corporation, no matter how trivial or casual his duties may be, is not engaged in casual employment.

There have, however, been some very sound opinions that are of value to employers in arriving at a solution of the problem of casual employment. In Indiana the commission said: "In general terms it may be said that a casual employee is a temporary, irregular, emergency, chance or pick-up employee, and that a casual employment is a temporary, irregular, emergency, chance or pick-up employment." Further, "it must be remembered that it is the business of the employer, not the business of the workman, which is the test of whether the casual work is, or is not, within the act. . . . A man's business is certainly that which occupies his time, attention and labor for the purpose of profit and a livelihood. That such is the meaning of the word as it is used in the compensation act is made clearly apparent by its use in connection with the words 'trade,' 'occupation' and 'profession.'"

Two Ohio Cases

In an Ohio case the injured workman had been employed to put a new flue in a boiler at a wage of 50c. an hour for the time required to complete the work. After working about two days he received an injury to his eye which caused the loss of sight. The commission held that because he had been employed to perform a piece of work that could be finished in a short time he was a casual emloyee within the meaning of the Ohio act. In another case in the same state, where the same decision was reached, an employee in a machine shop was employed by a construction company to repair one of its gas engines. Because this was a particular work, requiring only a limited time to perform, the commission held that it was casual employment and that the employer was not liable for the payment of compensation.

It will be remembered that the California commission stated that work lasting less than one week was casual and therefore the employee would not be entitled to compensation where the nature of the work done was not in the employer's trade or business. In another case, however, the commission announced an entirely different rule where it was shown that the work was in the employer's trade or business.

The injured workman was passing the so-called employer's place of business when he was asked to come in and help move some machinery. He was promised 25c. for his services. While moving one of the heavy machines one of the men dropped his end, causing it to fall upon the passerby's leg, breaking his ankle. The California commission held that "plainly, while the employment in this case was casual, it cannot be said that it was not in the usual course of the business of the employer. . . . Ordinary janitor work, which was really what was done in this case, although for only a very brief period of time, is in the nature of the business of any employer who conducts his business in any building which needs to be cleaned or with machinery which needs to be shifted from time to time. The applicant is therefore entitled to compensation."

Because of the apparent conflict in cases decided by the different authorities no general rule can be applied to all localities. Indeed justice can be secured in these cases only when each is decided according to the particular facts and circumstances surrounding it. This has long been recognized as the only true criterion to apply in compensation cases.

Employers are being confronted with the problem of casual employment at this time as never before. The emergency of the times and the conscription and shifting of labor create a situation that calls up the question of casual employment more frequently than did prewar conditions.

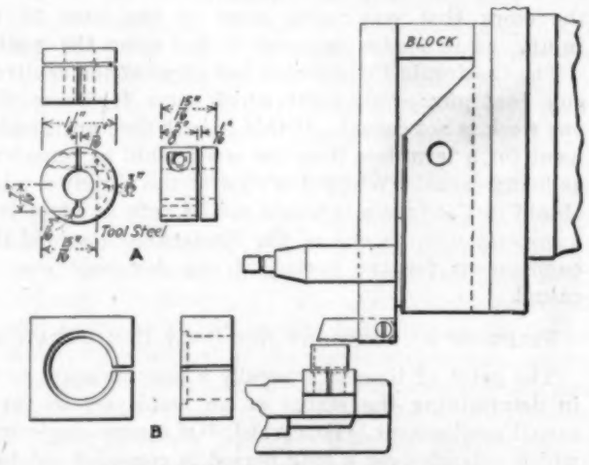
Employers must settle the problem with care, as the spirit of the times demands conservation not only in the matter of saving compensation premiums on insurance where it is not needed but above all else a conservation of our laboring forces.

Cutting a Narrow Slot With the Shaping Machine

By George W. Cooper

Having a number of pieces to make like *A* in the cut, I was confronted with the difficulty of cutting the slot which by reason of its great depth in relation to its width, and also of the limited amount of space available for chip clearance, presented an unusual problem.

The manner in which the work was done is as follows: The tool was a section of heavy hacksaw blade



METHOD OF CUTTING A DEEP SLOT

fastened in a holder of 1-in. by 1¼-in. cold-rolled steel, and the work was held in the split collar shown at *B*, which was in turn held in the shaping-machine vise.

The toolholder was blocked at the upper end to prevent it from lifting, and the cutting was done on the return stroke.

A slow speed was found desirable and close adjustment of the ram was necessary, but after getting started a substantial feed could be used, as each tooth of the saw did its own minute portion of the work and the chips were all pulled out clear of the piece, thus avoiding clogging and breaking the tool.

This method has proved so satisfactory that it has been applied to all work of this nature in the shop where I am employed.

Manufacturing a Shorthand Machine—I

BY M. E. HOAG

The shorthand machine is similar in many ways to a typewriter, but it embodies some mechanical features that can well be applied to machines intended for entirely different work. These, together with some unusual tools and dies, will be described in this article and others that are to follow in subsequent issues.

TO MOST laymen the action of the typewriter is familiar, but to the majority the shorthand machine is more or less of a mystery, though simple when understood. Its functioning depends on the simultaneous action of two or more type keys so arranged that an entire word is written at one downward stroke of the operator's hands, thus making practical a speed of operation that would not be possible with the ordinary typewriter, which requires a keystroke for every letter.

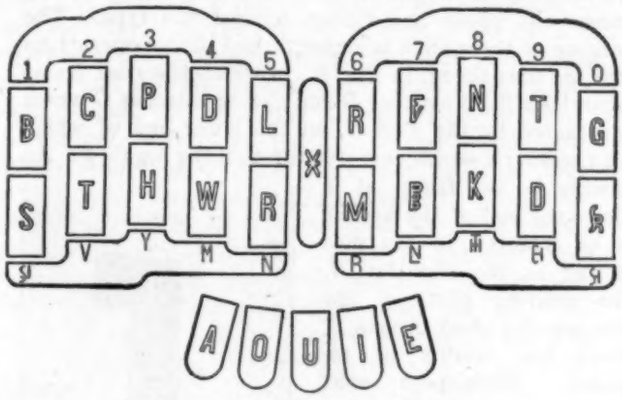


FIG. 1. KEYBOARD CHART

This must not be understood to mean that a message or letter can be written on the shorthand machine as on a typewriter, for the notes are written on a narrow roll of paper, each word requiring a separate line, and many of the longer or compound words requiring two lines. Code words or phonetic spelling in many cases are used.

Intelligent use of the shorthand machine does mean, however, that even though the words dictated to the operator may be unfamiliar mechanical terms or even foreign words or phrases, the operator will be able to represent them phonetically and they may afterward be translated into correct spelling.

The shorthand machine is made possible because most words of the English language begin and end with consonants having vowels between them. For this reason the keyboard is divided into three sections as shown in the chart, Fig. 1. If any of the 25 keys are struck, the letters indicated on the key chart will be printed on the paper, but if the shift bars shown above and below the middle sections are depressed at the same time a key is struck there will be printed either a figure or a letter as indicated on the chart. That is, if the B key is depressed alone, the letter B will be printed on the paper; but if the upper shift bar and the B key are depressed at the same time, the figure 1 will be printed.

THE VOWELS

The row of keys below carry but one set of type—the five vowels. On a few keys characters are used to indicate a combination of two letters, such as ch and th. These features render the shorthand machine especially valuable where mechanical or technical terms are being dictated to a typist who is not familiar with them, and it is also possible for one operator on a shorthand machine to take enough dictation to keep several typists busy, for one operator can always transcribe the notes made by another, something impossible when shorthand is used.

In the first shorthand machine placed on the market the paper passed through the machine in a continuous strip. This has some objectionable features, so a cutting and filing attachment was devised by means of which the strip of paper is cut into lengths and stuck on a file where they remain until removed by the operator. This also places the notes in more convenient form for transcribing. The file point is shown at *A*, Fig. 2.

THE CUTTING DEVICE

The cutting device consists of one curved blade mounted on a rotating holder *B*, and one straight swinging blade *C*, which is held in contact with *B* by a spring, the two blades having the same action as ordinary hand shears. The strip of paper passes between them, and as the upper, or curved, blade comes down, it shears it and at the same time forces it onto the file.

The shear blades shown separately at *D* and *E* are made from cold-rolled steel, casehardened and ground.

An interesting cam movement is used to operate the shear at the correct instant. Each key depression by the operator indexes the cam and feeds the paper a fixed distance so that it is impossible for the shears to cut through a line of lettering. It is also possible to feed and cut the paper by hand when desired. The cam and levers are shown in Fig. 3. The lever *A* carries a hardened projection which bears on the cam *B*, and is kept in contact by the spring *C*. The operation begins

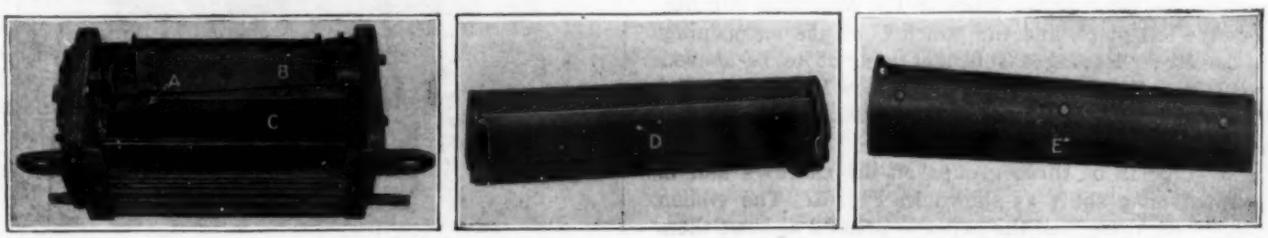


FIG. 2. THE PAPER-SHEARING MECHANISM, SHOWING THE BLADES SEPARATELY

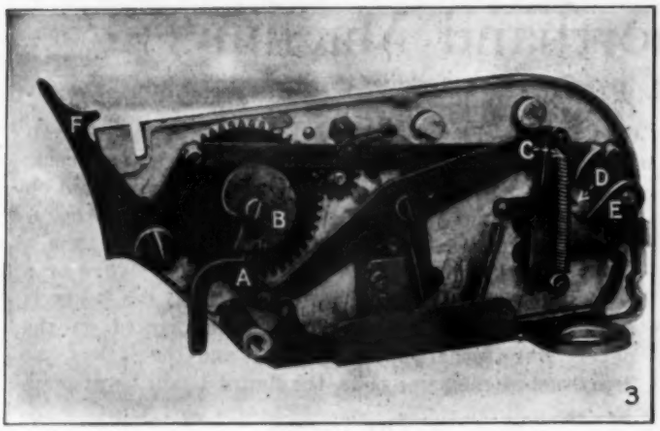


FIG. 3. CAM MECHANISM FOR PAPER SHEARS

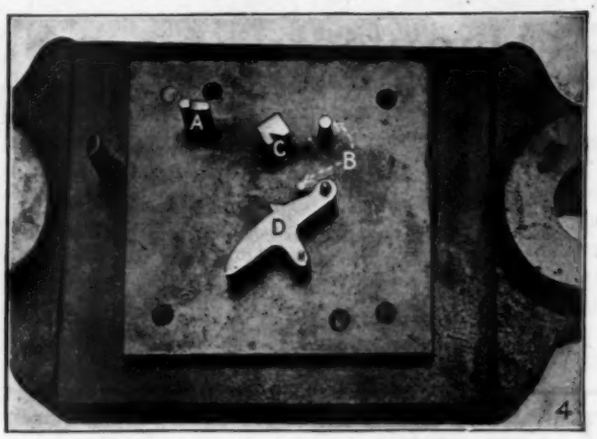
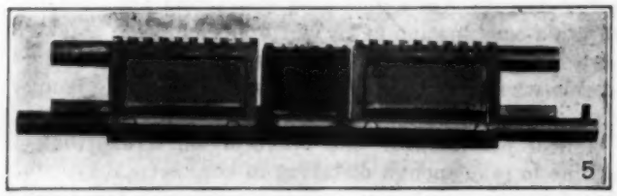
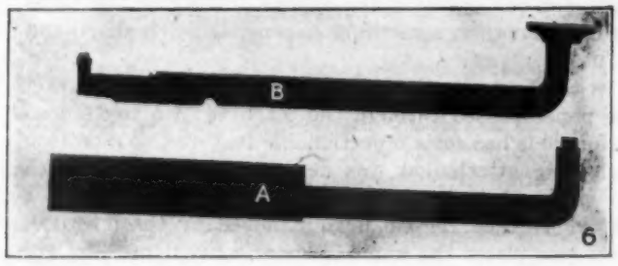


FIG. 4. PROGRESSIVE SHEARING AND BLANKING DIE





FIGS. 5 AND 6. THE TYPE AND THE KEYBAR
Fig. 5—Type castings on shaft. Fig. 6—Blank and finished keybars

at the lowest point of the cam, and as the paper feeds through the machine the cam gradually advances and puts the spring *C* under greater and greater stress until the highest point is reached, when the lever drops, causing the point *D* to engage the point of the lever *E* and depress it by action of the spring *C*. The lever *E*, being attached to the shaft of the rotating shear blade, produces the desired action and shears the paper. The lever *F* may be operated by hand to cut the paper at any time desired.

An Unusual Shaving Die

As the points of contact on the levers *D* and *E* must be smooth and accurate it is necessary to shave them. These shaving operations are usually handled in separate dies after the piece is blanked, but the punch shown in Fig. 4 is progressive, blanking and shaving the lever *D*, Fig. 3, in one operation. The punch *A*, Fig. 4, cuts an opening for locating the stock in the die. The punches *B* pierce the piece, and the punch *C* blanks an opening in the stock, leaving a sufficient amount to be shaved from the point *D*, Fig. 3, by the punch *D*, Fig. 4. The die for this piece is simple in construction and needs no description.

The type is in three groups on die castings and is mounted on a shaft as shown in Fig. 5. The ribbon passes over these, and the paper is pressed against them by the ends of the keybars shown in Fig. 6. All of these bars are blanked out with one die in the form shown at *A*, and are afterward trimmed to various lengths. A completed bar ready for assembling in the machine is shown at *B*. The ends of the keybars are swaged to form a rectangular opening, as shown in Fig. 7, and are fitted with a rubber bumper which presses the paper and ribbon against the type. The swaging of these ends is accomplished in two operations with the dies shown in Fig. 8, in which the steel frame *A* carries a fixed member *B* and sliding member *C* which is actuated by the stud *E*, on the lower end of which is an eccentric which operates through the toggle *F*. An opening in the frame at *G* allows the end of the keybar to be inserted in the dies as far as the shoulder *H*. The wearing parts of the dies are the steel inserts, *I*, which can readily be replaced. High-speed steel punches are used, the first one upsetting the end of the keybar and the second one forming the depression. The second die is more properly an extruding die and not a swaging one, as it produces a reversed flowing of the metal which was swaged up in the first operation.

FIG. 7. END OF KEYBAR

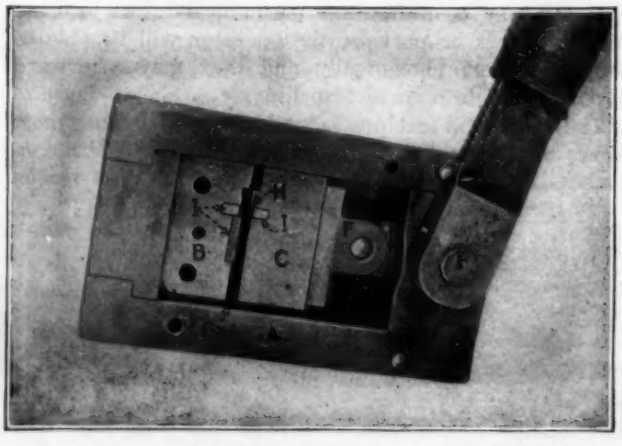


FIG. 8. SWAGING DIE FOR END OF KEYBAR

Interpreting Labor Turnover

By LUTHER D. BURLINGAME
Industrial Superintendent Brown & Sharpe Manufacturing Co.

The expression "labor turnover" is often variously interpreted. This article gives some definite information as to its real meaning and how it should be computed. The article also has special value coming from one of the best known machine-tool building shops in the country.

IN THE *American Machinist*, Vol. 49, page 297, Entropy raises the question "What Is 'Labor Turnover'?" and emphasizes the thought that at the present time the term "labor turnover" is very indefinite because it is interpreted in such widely varying ways by those making use of it.

That this is a just criticism is borne out by the statistics that have been published in recent years, it being often impossible to make comparisons of any value unless the basis is given on which the percentage of labor turnover is figured. Further, even if the basis of this percentage is known, comparison may lead to far from correct conclusions unless the many varying elements involved are given due weight. To illustrate:

a. Consider a force of 100 men at the beginning of the year remaining at 100 at the end of the year. During this period assume that 20 have been hired and that 20 have left. If the 20 who left were the same 20 who were hired and the 100 remaining at the end were those originally employed, the extra number having been hired simply for special work, there is really no turnover so far as the original force is concerned, while as ordinarily figured there would have been a 20 per cent. turnover.

Suppose on the other hand that 20 of the most highly skilled and responsible employees had left and had been replaced by inexperienced, untrained workmen. Then the turnover, while figuring the same percentage, would mean a radical reduction of the efficiency of the force.

b. Assume 100 men employed at the beginning of the year and the force reduced to 80 at the end. Further, that during this time 60 leave and 40 are hired. Here, again, it is possible that the 60 who leave may include the transient and inexperienced 40 who are hired, and in addition 20 of the least valuable of the old force who are culled out because of inefficiency or other failings.

Suppose, on the other hand, that all of the 60 who left were from among the experienced men in the original 100; the 80 then remaining, including the 40 inexperienced new employees, would figure the same percentage of turnover, but would give a radically different showing as to the efficiency of the factory and its employment department.

c. Suppose again 100 men are employed at the beginning of the year and 120 at its close, 40 men leaving and 60 being hired during the period. The 60 hired may be entirely to obtain the 20 increase of force, the 40 leaving being from these 60 hired, not one of the original 100 having left. Here again the results would be radically different from those obtaining if 40 of the original 100 had left and had been replaced, the 20 hired to fill positions additional to the original force having stayed. The latter might reflect credit on the employment department as having made such a careful selection that the first employees tried stayed, while the former would show more stability in the permanent force.

In practice neither of these extremes is found, but the degree that each becomes a factor has an important bearing on the success of dealing with the labor problem, and the relative proportion of each, together with many other factors, must be considered in order to intelligently analyze the statistics of turnover.

Previous employment is also an important factor, as the cost of breaking in is materially less in rehiring employees, especially if put on the same work they had previously done.

The comprehensive investigations of turnover in factories made under the supervision of Magnus W. Alexander shows that on an average 25 per cent. of employees hired have previously been in the service of the same employer. The experience at the Brown & Sharpe works during the periods when such statistics have been gathered shows even a higher percentage of rehirings, this going to 34 and even to 38 per cent. of all hired.

Effect of Rehiring

Where the percentage of rehiring is large it will be seen that this becomes a material factor which must be given weight in interpreting the statistics of turnover. Further, it is necessary to make an analysis of reasons of leaving before such information can be used for intelligent comparisons either between different periods in the same factory, between the employment of men and women, between different races or between employment conditions in various factories or sections of the country.

In an effort to find a rational basis for estimating turnover and the degree of stability it has been found that to ascertain the "jobs made vacant" in the given period under investigation and then the "number hired per job made vacant" has given a more instructive and useful basis of comparison than the percentage of turnover, which, as has already been pointed out, gives an elusive and indefinite comparison.

To obtain the "jobs made vacant" the length of service of those leaving must be known, and generally speaking the average length of service of those leaving who have been employed less than one year shows how many times a given job, whether a new or an old one, has been taken up by a new employee. Thus for employees averaging one and one-half months' service the same job would have to be taken up eight times, and if there are 800 employees who have left, with an average of one and one-half months' service, then the 800 would represent but 100 jobs. On this basis, dividing all employees leaving having less than a year's service into groups, say by each three months, and finding the number of "jobs made vacant" on the basis described, then adding those leaving who have been in service a

year or more, and also adding the increase of force or subtracting the decrease of force (whichever is required) will give the total "jobs made vacant" which have been filled, and from this it can be learned (a) what proportion this is of the total number of jobs in the factory and (b) the number of employees hired for each job vacant. To illustrate:

a. With 5866 employees at the Brown & Sharpe works at the beginning of the year 1917, representing 5866 jobs, it was found that 1997 jobs were made vacant during the year by employees leaving, which indicates that 34 per cent., or practically one-third of the total jobs (not including new jobs, increase of force), were supplied by new workers, while the remaining two-thirds remained stable even though 5358 employees left during the year.

While the nominal turnover for the years given in Table I would as often figured be in the neighboorhood of from 75 to 100 per cent. it will be seen that only from one-quarter to one-third of the jobs were "made vacant" in any year recorded, so that instead of the

TABLE I. PERCENTAGE OF "JOBS MADE VACANT" AS COMPARED WITH TOTAL FORCE (NOT INCLUDING INCREASE IN FORCE), BROWN & SHARPE MANUFACTURING CO.

Date	No. of Employees At Beginning of Year	"Jobs Made Vacant"	Per Cent.
1912	4,390	1,250	29
1916	5,463	1,343	25
1917	5,866	1,997	34
Four Months of 1918	7,295	750	10.3 or on yearly basis 31

interpretation often given that 100 per cent. turnover means that a workman is replaced on every job from two-thirds to three-quarters of the force may have remained. Further if one-third of the new employees have been rehirings the actual loss from turnover is that much further reduced.

One trouble with the use of statistics is that they are often so applied as to seem extreme, and not to stand the test of common sense, so that instead of convincing they tend to discredit. Statements about the perecentage and cost of turnover based on undigested statistics sometimes seem to be of this character.

b. In comparing the stability of men and women at the same works during the first four months of 1918 it was found that out of 2537 employees leaving 2123 were men and 414 women. Of the men leaving 1339 had been employed less than three months, 392 three to six months, 161 six to nine months, 53 nine to twelve months, and the remainder one year or over. In the case of the women leaving during the same period 274 were employed less than three months, 63 three to six months, 52 six to nine months, 18 nine to twelve months, and the remainder one year or over.

On the basis of the method above outlined 638 jobs were vacated by the men leaving, while 112 vacated by the women leaving, a total of only 750 jobs made vacant even though 2537 employees left.

The fact that practically two-thirds of all leaving have been employed less than three months shows that it is the constant turning over of this transient and in the main irresponsible portion of the force (emphasized by the fact that 158 of those leaving had worked only one day or less) which makes the high record of turnover, and while it is important to reduce this it is but the froth on the surface as compared with the stable force of employees, many of whose terms of service have long passed the quarter century mark. On the above basis of figuring, about three men were hired for each "job made vacant" as compared with 1.8 women hired, or for the total force 2.6 were hired for each job.

This gives a basis also for comparison with previous years, where by the same method of figuring it was found that in 1912 and 1913 two employees were hired per "job made vacant," this increasing to 2.4 in 1916, but being reduced to 2.2 in 1917, due largely to the good showing made at the start in the employment of women, their record in this respect being materially better than that of the men. The increase during the four months of 1918 covered in the report is readily accounted for by the increased stress of war conditions. It is also due to the fact that women employees are approaching more nearly to the standard of the men in the matter of turnover and that the better showing which they made at the start is not being fully maintained, although it still shows greater stability.

Thus, in 1917 the number of women requiring to be hired per job vacant was 1.5 while in four months of 1918 it was 1.8. Even this latter, however, was less than two-thirds as great as for men during the same period.

These figures do not take into account previous employment by the company because it is desired to learn the degree of restlessness or change appearing in the force. As already pointed out, such previous employment becomes important in ascertaining the cost of turnover and the amount of training required for new employees before their employment becomes profitable.

Generally speaking it can be considered a good indication when the percentage of rehiring increases, as it indicates satisfactory working conditions and surroundings, at least to a degree which makes employees desire to return to their former place of employment.

Reasons for Discharge

Another important matter to be considered is the relative number discharged and leaving voluntarily, and the reasons for each. For those under the heading of "Discharged" the principal reasons can be assigned to unsatisfactory work, lateness and absence, reasons of discipline and miscellaneous.

Under the classification of "Leaving Voluntarily," it is of importance to know whether (a) it is to take other positions; (b) dissatisfied with work or pay; (c) poor health or death; (d) leaving the city (this to apply only to young persons or others who leave because of the family's removing); (e) change of vocation, returning to school, etc.; (f) marriage (especially applicable in case of women employees); (g) miscellaneous.

Table II illustrates the method of making an analysis along these lines, the comparisons being made between men and women employees for the year 1917 and the first four months of the year 1918, which shows that while of the women leaving because discharged about the same proportion as of men were discharged for unsatisfactory work, that under the heading of "Lateness and Absence" a larger proportion of women than of men were discharged. On the other hand, for reasons of discipline a much smaller proportion of women than of men were discharged.

In proportion to the number hired the percentage of women discharged has been much less than of men,

although with continued employment their record is approaching that of the men. Thus in 1917 23 per cent. of the men hired were discharged, while the percentage was only 11 for women. In four months of 1918 16 per cent. of the men and 12 per cent. of women hired were discharged. In the case of both men and women there was a smaller percentage of discharges during the first four months of 1918, indicating a greater effort to hold on to employees and try to make them profitable members of the organization than in earlier times when the labor market was not so stringent.

Among those quitting voluntarily the percentage of women leaving on account of poor health is greater than

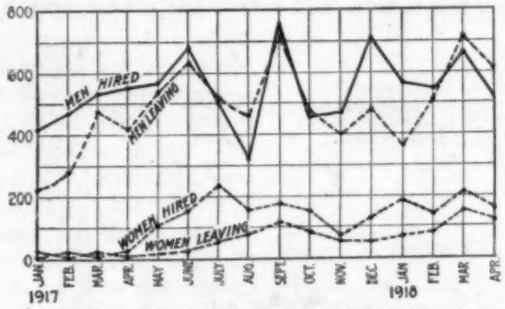


FIG. 1. CHART OF SEASONAL CHANGE, 1917, AND FOUR MONTHS OF 1918

that of men, this applying also to those leaving for "a change of vocation."

In the case of women, disturbances in the home more quickly affect them than men; also while the question of marriage does not usually affect the employment of men, it usually does affect that of women.

In giving reasons for leaving under the heading "Poor Health" reference is made only to the poor health of the employee herself and does not include caring for others. Even this is often very difficult to classify, as the reason given for leaving employment may be leaving the city, or going on a farm, or taking another position, when in reality poor health is at the bottom of the desire to change. Under the heading of "Leaving the City," this too can generally be considered as taking another position, although it is a reason which should usually be confined in the records to young employees who live at home and who have to leave because the family is leaving the neighborhood.

The question of rehiring cannot have full weight in considering the employment of women, especially as compared with men, when the women have been employed in the shop but a short time and when there has been little opportunity for rehirings.

The question between leaving voluntarily and being discharged is also one that must be further analyzed and the basis known in order to interpret the figures intelligently. Thus when about 25 per cent. of the employees leaving are discharged according to the records we must bear in mind that there is another 15 or 20 per cent. who leave voluntarily but are marked on the cards "Unsatisfactory" and who would have been discharged except for their having anticipated their dismissal. In this we are reminded of the story of the tramp workman who bragged that he had never been discharged, he having prided himself that he always forestalled the boss when a discharge was coming by quitting.

In studying the drink question the reason given for discharge on account of lateness and absence is so often mixed with that of being discharged for drunkenness that it is felt that to the too large number recorded as discharged for drunkenness there should be added a material percentage that is discharged for lateness or absence with the drink habit as the underlying cause, thus bringing home the menace that the saloon is to industry and the urgent need of eliminating it in the interests of essential production as a war measure.

Another matter that affects turnover and makes the present standing of the men in the statistics given less favorable as compared with women is that night work is distasteful, and many men leave because they object to such work, while women, not being employed on night work, do not leave for this reason.

In the classification of those who left voluntarily it will be seen that more than double the number in proportion of women than of men have left on account of poor health, while a much smaller percentage of women have left to take other positions or because of dissatisfaction. The number of women who are transients in the sense of taking a job temporarily with the intention of going back to housekeeping, returning to school, etc., is shown to be larger than the number of men in this class.

Another line of analysis is the seasonal change, the

TABLE II. TURNOVER OF FORCE AT BROWN & SHARPE MANUFACTURING CO. BY COMPARISON OF 1917 WITH FIRST FOUR MONTHS OF 1918

	Men				Women				Total			
	1917		Four Months 1918		1917		Four Months 1918		1917		Four Months 1918	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Number of employees at beginning and end	5,655 / 6,395	....	6,395 / 6,489	....	212 / 901	....	900 / 1,156	....	5,867 / 7,295	....	7,295 / 7,645	....
Number entered	5,569	....	2,217	....	1,218	....	670	....	6,787	....	2,887	....
Number left	4,829	....	2,123	....	529	....	414	....	5,358	....	2,537	....
Net increase	740	....	94	....	689	....	256	....	1,429	....	350	....
Discharged	1,279	27.0	346	16.3	134	25.4	79	18.9	1,413	21.0	425	15.0
Left voluntarily	3,550	73.0	1,777	83.7	395	74.6	335	81.1	3,945	79.0	2,112	85.0
Discharged:												
Unsatisfactory work	431	9.0	119	5.6	46	8.8	30	7.3	477	7.7	149	5.9
Lateness and absence	381	8.0	103	4.9	65	12.3	27	6.5	446	7.2	130	5.1
Reasons of discipline	366	8.0	99	4.7	15	3.0	11	2.7	381	6.1	110	2.9
Miscellaneous	101	2.0	25	1.2	8	1.3	11	2.7	109	1.8	36	1.4
Left Voluntarily:												
To take other positions	1,724	36.0	804	38.0	117	22.0	71	17.0	1,841	29.6	875	34.5
Dissatisfied with work or pay	965	20.0	479	22.5	85	16.1	86	20.7	1,050	16.8	565	22.3
Poor health or death	291	5.1	172	8.1	63	12.0	66	16.0	354	5.7	238	94.0
Leaving city	372	8.0	125	5.9	17	3.0	31	7.5	389	6.3	156	6.2
Change of vocation, returning to school, etc	74	1.5	102	4.8	28	5.0	40	9.7	102	1.6	142	5.6
Marriage	....	....	....	....	27	5.0	11	2.7	27	0.4	11	0.4
Miscellaneous	124	2.5	94	4.4	58	11.0	30	7.3	182	2.9	124	4.9

fluctuations of which can be predicted with some accuracy after a study of the subject. An analysis of this kind is shown in diagrammatic form with separate charting for men and women in Fig. 1. This shows the number of each hired and leaving by months during a period of 16 months, beginning January, 1917, and indicates at a glance the months in which more men were leaving than were hired.

In the case of the women employees it will be seen the number hired each month exceeded the number leaving. From statistics like these, kept on a uniform basis and compared from year to year, much of value can be learned in dealing with the labor problem.

If a record could be kept with sufficient discrimination showing the degree of skill of those leaving it would be of special value in regarding turnover, but statistics are difficult to obtain with a measure of accuracy such as to be of material value.

That the question of reducing turnover is being given more the attention it deserves by many manufacturers is shown by the various steps, often taken at great expense, looking toward increasing the stability of the force, such as just treatment, prospects of advancement, adjustment of grievances, pleasant and sanitary working conditions, etc.

Projects for Making the Contents of the Pay Envelope Go Further

Other features are various projects for making the pay envelope go further, like coöperative buying of groceries and other necessities, company gardens, mutual-aid societies, insurance (especially where special advantages are given on account of long service), encouragement of thrift in saving, home building, etc. Some em ployers give direct money bonuses at the completion of a certain length of service; others give an added percentage of wages for regular attendance, but held back for several months and forfeited if the employee leaves. Another method is to pay new employees more than they are worth at the start in order to hold them until they have passed the breaking-in period and can make good at the established wages.

As many of these methods serve their purpose for time but are often later abandoned, it can be assumed their helpful effects are only temporary. As a general rule fair treatment and an opportunity for self-expression as distinguished from paternalism are most effec tive in keeping a stable, satisfied force. It is, however, important in these times of stress to keep close watch on the labor pulse by means of turnover statistics intel ligently interpreted.

The War-Time Machinette

By Hi Sibley

Woman has taken man's place in the war-time shop.

How's that for a "bromidic" introduction? If you haven't been totally unconscious from the neck up you knew that a year ago. Feature writers from Bridgeport to Bakersfield, in a hundred Sunday sheets, have worried this simple fact like a wire-haired terrier and have played it up from every curve and angle.

You have read how Angelica McGink, who never hefted anything bigger than a fluting iron in all her sheltered life, has hopped boldly into overalls and is now forging plowshares into battleships. Bully for Angy! Temperamental, sentimental, saccharine scribblers at paper-hangers' space rates have sung of alluring Amazons of industry, of the face powder behind the gunpowder, of blondes in bloomers and brunettes running bulldozers, and your imagination doesn't have to be very spry to picture a shopful of pink-and-gold machine tools and canaries and lovers' bows all over the place.

Also, if you haven't become dizzy on that panorama, you probably have assimilated a few dozen galleys about woman in war time "enlarging her sphere." Woman may be reducing her hips in the process, but as for enlarging her sphere, said sphere has always been a coop,

and we smug men folks jolly well know it. Why shouldn't she want to break out of it? When her so called "sphere" has been a world of washtubs and sweltering kitchens and stove stoking and piano moving and other feminine frivolities at an East Indian coolie's wages it is logical that she should wish to push off from the barren shores of domestic drudgery to explore the richer lands of masculine endeavor when opportunity offered.

Now let's give this serious-minded woman worker credit for her real value in industry. As an economic factor she is nothing less than a godsend. The man in the shop has even been loath to concede the efficiency of woman at so-called "men's jobs." But that is pardonable; the case might be likened to a fond mother's reluctance to praise a neighbor's precocious child. It has been somewhat of a surprise to Bill to have Doris, whom he regarded indulgently and incapable in everything outside her immediate "sphere," invade his domain of belts and gears and make good.

But that attitude has changed. Woman has proved herself as adaptable in the American industrial field as the male of the Yankee species has shown himself to be in the French trenches, and no one is more willing to admit it now than the shop foreman. Instead of being a problem the female worker is rather the solution of one, and her presence in the shop has made man's place more secure by the stabilizing of industry in general.

Recognizing the value of women workers one large concern in the Middle West, foreseeing an army of 5000 women where 1200 are now employed in its shops, has

instituted means of securing the most desirable individuals among the female help available. A woman's technical training school has been inaugurated in which applicants are instructed in reading blueprints, using calipers, snap gages, micrometers, protractors and the like, later to be put on machines in actual production work before they leave the school. In addition instruction is given in inspection and assembling work.

This school not only serves as a means of combing out undesirables and incompetents, but saves the shop foreman much annoyance and time otherwise consumed in teaching the neophyte the use of a machine and a specific operation. Moreover, through the gradual steps in the school, the woman overcomes her natural timidity in operating more or less noisy and rapidly running machines in the shop where the confusion is more distracting. As a result the school graduates are capable of taking their places alongside men workers in the shop and of going into production work without delay, and the demand for them is always greater than the supply. At this writing about 600 students have graduated into the shop. and there have been as many as 54 applicants in a single day. Singularly enough it has not been necessary, nor practicable, for that matter, to segregate the women to secure the best results. The men are disposed to be helpful wherever possible, and their generous cooperation is most propitious for the future of female labor. It is also interesting to note that few special precautions against accident are required for these petticoated workers. On the whole the women are more cautious in operating machines, less prone to injury resulting from carelessness and incidentally more conscientious about caring for tools and machines. After the woman is at home with her job, breakages and spoiled work average very low.

As to her efficiency much can be said in her favor without disparaging her male coworker. In the first place her native appreciation of detail tends to make her a stickler for accuracy, and no one can deny that she is a speedy worker. In one case at least she has turned a certain operation which her male predecessor abandoned as profitless into a paying job, and another instance is reported where a woman doubled a man's output in another operation. In sheet-metal welding in this shop she has become especially proficient, making more at this difficult work than at any other job. Of course it must be borne in mind that we are comparing her not with the experienced male mechanic but with the average of the employment-office applicants whose places she is taking.

A much higher type of women may be found in the shops than before the war created such remunerative opportunities. Many of the women are wives of men who have been called to the colors and to whom shop work was an unknown field before they applied at the school. Others are girls whom war conditions have forced to earn their living for the first time in their lives. Generally they have good educations, and obviously become alert and efficient operatives. Although the work at first is somewhat trying, they find it requires no more endurance than the customary domestic duties of their former "sphere."

Another plant employing women, though not such a large number, presents interesting phases, since it is in a small town some distance from industrial or metropolitan centers, and the girls it employs are largely drawn from farms and the schoolroom. The supervisor of women, or "director of machinettes," as she is called, is a young and engaging ex-schoolma'am, a college graduate with distinctly feminine instincts, and who admitted no little courage was required to take up shop work in the face of social prejudice. However, she freely confesses that her present activities are far more thrilling than any other line open to her, and the patriotic and constructive appeal has been a strong one. With a few months' preliminary training she now instructs and directs a hundred or so young women, few or none of whom had ever been inside a shop before. Among her force of workers are other schoolma'ams, high-school graduates earning money for a college education, daughters of prosperous farmers and even a trained nurse or two. With the *American Machinist* as their text book—it occupies a prominent place in their little recreation-room library—these enterprising young workers have manifested a keen interest in the broader phases of scientific and efficient manufacturing, and as the demand increases many of them will become proficient forewomen themselves.

The thousands of women employed in industrial plants all over the country are a fair demonstration that they have wanted to accomplish useful work in this period of Uncle Sam's need and they only asked to be shown how. It is not a fad with them, but a conscientious desire to turn their natural talents into substantial and tangible results. Let us give them full credit for that.

Using Rimless Cartridges in New Service Revolvers*

By Paul Allen MacKenzie

One of the latest improvements in firearms, due to the stimulus added to this industry by the war, is the adaptation of a revolver for high-velocity rimless cartridges loaded in clips.

Some time ago the Government placed an order with the Colt's Patent Firearms Manufacturing Co. for 100,000 new service revolvers of this type and at the same time placed a similar order with the Smith-Wesson Co. for 150,000 Model 1911 revolvers. This led to the circulation of the gross fallacy that the 45-caliber Government Colt automatic was a failure and that it was given up by the Government in favor of a new type of double-action revolver. What this gun was, of course, nobody knew.

Since the American troops have been on the firing

*Passed by the Office of the Chief Military Censor, Washington, D. C., Oct. 16, 1918.

line in France they have proved conclusively that the 45-caliber Colt automatic pistol, in their hands, is the most efficient side arm that has ever been produced. In fact, it has proved itself of such value for offensive work in raiding and for defensive work in case of surprise that the Government has placed orders for this weapon far in excess of previously estimated requirements. Infantrymen are now carrying the Colt automatic in the trenches and officers in advance posts carry two.

As an illustration of this the following item of news was taken from a daily paper: "Sergeant Naughton killed a German lieutenant and two soldiers. He was challenged by the lieutenant to leave his dugout and led out his men fighting."

American Marksmanship

The American has long held the reputation of being the finest marksman in the world, and, recognizing his natural tendency to shoot, which is much more deadly and effective than bayoneting or hurling bombs, General Pershing has laid great stress on the proper instruction of the troops in rifle and pistol practice. American marksmanship is already making itself felt on the Western front.

German sniping, which was one of the greatest sources of trouble when the Americans first occupied their sector, has been almost entirely abolished, due to the superiority of marksmanship displayed by our troops, and undoubtedly as time goes on it will be found that the Americans will rely on the rifle and pistol rather than on the more uncertain hand grenade and bayonet.

It was to relieve this pressing demand for side arms in excess of the requirements anticipated earlier in the war that necessitated the purchase of these revolvers, and certainly no more sensible action could have been taken or a finer substitute secured than the two revolvers selected.

The production of Colt automatics has been increased over 200 per cent. in six months, but it was not sufficient to take care of the immediate needs.

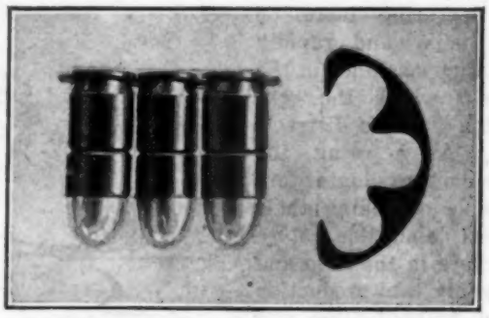
Change in Needs

Last fall it was felt that the 500,000 pistols ordered from the Colt company were ample for our needs. But in view of the conditions just described it has been decided to greatly increase this order, with the result that 500,000 more Colt automatics have been contracted for with the Remington company and a contract for an equal number will soon be placed with the Winchester company. This in itself should be conclusive proof of the War Department's opinion of the 45-caliber Government automatic.

The Colt company had some new-service-model and the Smith & Wesson had some 1911-model revolvers on hand and lots of extra parts also, and, more important still, all the necessary machinery already set up for immediately turning out these arms, which they made in large quantities in peace times.

The value of uniformity in ammunition for military purposes is, of course, well known. There was a considerable quantity of 38-caliber Colt revolvers, Model 1904, which had been discarded some years ago, stored at the arsenals or in the custody of the National Guards, but it was impractical to use these because of the danger of mistakes in issuing ammunition, such as was experienced in the Spanish-American war when several different calibers of arms were in use. Also our production of the standard Government cartridges for small arms (the 45-caliber-pistol cartridge and the 30-caliber-rifle and machine-gun cartridge) at the present time is far in excess of our present needs, and the adoption of a new cartridge, even as satisfactory as the present standard cartridge, would have disrupted our production.

It was a small matter to make a clip to hold the rimless 45-caliber automatic cartridge and to cut down the



CATRIDGES AND CLIP

rear end of the cylinder in the revolver so that this rimless cartridge could be used in the revolver known as Model 1917 as well as the service automatic.

The only other necessary change was that more careful adjustment should be made in the alignment and close bearing of the front end of the cylinder against the base of the barrel, so that there would be little gas leakage which would result in weakening the velocity. The result was most satisfactory.

Comparative Velocities

The velocity of the Colt 1917 revolver or the Smith-Wesson 1917 revolver was reported to compare very favorably with the power of the automatic. What little power is lost in the revolver through gas leakage is probably balanced by that used in the operation of the automatic pistol.

The clips are loaded by a specially made machine and the cartridges are issued to the troops in the clips, the same as rifle ammunition is distributed. Six of these clips are carried in a pouch made for the purpose, which, with the loaded gun, gives the soldier 24 rounds of ammunition. Rapid loading is greatly aided, as it is reduced to two operations instead of six. The clips fit in easier and eject easily. In fact, in my opinion, it is easier to drop the clip with three cartridges into the chamber than it is to insert one cartridge as was done in the old way, and there is less likelihood of dropping ammunition when in a hurry.

The rapidity with which this gun can be loaded and fired by those trained to use it is remarkable. It is not intended that it will ever take the place of the Colt automatic permanently. As a military gun the Colt automatic undoubtedly stands supreme, but as a substitute for the automatic, and as a neat, handy and practical weapon for the many sportsmen, military officers and gun cranks who prefer a revolver to an automatic it is undoubtedly a big improvement.

War Inventions Wanted

THE Inventions Section of the General Staff has issued a list of important inventions wanted. Those that apply especially to the mechanical field are here given. The problems are stated in detail and the difficulties to be overcome and suggestions for solutions are clearly outlined. Ideas and suggestions should be submitted to the Inventions Section of the General Staff of the Army War College, Washington, D. C.

A Better Fire-Control Gear for Fixed Machine Guns on Airplanes.—The forward machine gun on an airplane is fixed and fires between the propeller blades in the direction in which the machine is headed at the time of firing. The function of a fire-control gear is to control the fire of an aircraft machine gun shooting through the propeller so that no shots will be fired when the blades of the propeller are in a position where they are in danger of being struck. This is done usually by a cam attached to the crankshaft or geared to the propeller, which sends an impulse by mechanical or hydraulic means to the trigger mechanism of the gun only when the propeller is in a safe position for the gun to be fired. This impulse trips the trigger and a shot is fired. As gears are now designed two impulses are given to the gun every time a blade of the propeller is in a certain position with reference to the bore of the gun.

Fire-control gears are of two types—hydraulic and mechanical. The advantages and disadvantages of each type are here described:

Hydraulic Gear.—Advantages—(1) Allows the gun to be placed in any position with reference to the engine, inasmuch as the hydraulic pipe line can be bent. Disadvantages—(1) Difficult to fill and take care of; requires a good deal of special training and experience to get good results; many small parts to get out of adjustment; difficulty from leaking; (2) lag in impulse due to time taken by hydraulic wave to pass down pipe line which causes a wide dispersion of shots for changes in the revolutions per minute of the propeller; shots fired at low revolutions per minute fall too near one blade of the propeller and shots fired at high revolutions per minute too near the other blade; thus the safety margin is cut down and revolutions per minute at which the gun may safely be fired is limited; (3) at low revolutions per minute the impulse changes from a pressure wave to a simple hydraulic action and the gear cannot then be depended on.

Mechanical Gear.—Advantages—(1) Action always positive and certain; (2) no lag of impulse in transmission; (3) easily taken care of and adjusted. Disadvantages—(1) Position of the gun limited with reference to the engine, as it is difficult to send an impulse around a corner; (2) in case where an impulse is transmitted by rods difficulty is encountered from the whip; (3) wear in rods and cams affects timing.

Disadvantages of both types of gears—(1) In both types the principal drawback is the dispersion of shots between zero speed and maximum speed, which limits the type of propeller used and limits the safe firing speeds; this is greatest on hydraulic gears. (2) Rate of fire of gun dependent on revolutions per minute of propeller. For example, if a machine gun is designed to shoot 800 shots per minute and the propeller is turning over at 400 revolutions per minute, or 800 impulses are given per minute, the gun will fire on every impulse and the rate of the geared gun will be 800 shots per minute If the propeller is turning at 500 revolutions per minute, or giving 1000 impulses per minute, the gun cannot use every impulse, but will use every other impulse, and the rate of fire will only be 500 shots per minute or the efficiency will be decreased. This is an important disadvantage of the present system.

The ideal fire-control gear—(1) Maximum rate of fire is obtained at all revolutions per minute of the propeller; (2) the time of impulse is advanced as the propeller speed increases so that shots at maximum speed will fall in the same position with reference to the blades of the propeller at the plane of the propeller as shots at zero speed; (3) easily placed at any position with reference to the engine; (4) simple to take care of and adjust.

It is obvious that if the first advantage is obtained the second must be sacrificed, but a better combination of the two is desired than what we have at the present, and the problem that presents itself is to devise a fire-control gear that incorporates the above advantages, the solution of which seems to lie in an electrical system.

Calculations must be based on the following data: Distance from muzzle of gun to plane of propeller varies from 3 to 6 ft.; maximum propeller speed, 1600 revolutions per minute; rate of fire of airplane machine gun, 1200 shots per minute.

New Rear Sight for the United States 30-Caliber Model 1917 Rifle.—It is desired that designs be submitted for a new rear sight for the United States 30-caliber model 1917 rifle. The present rear sight is not entirely satisfactory because the rifleman cannot readily bring the point of impact of the shots to coincide with the point of aim. The present sight can be adjusted only for hundreds of yards of elevation, it not being possible, for example, to adjust it between 400 and 500 yd.; also there is no lateral or windage adjustment.

It is desired that the new sight have adjustments whereby the rifleman can readily bring the point of impact to coincide with the point of aim as was true with the rear sight on the United States 30-caliber model 1903 (Springfield) rifle. It is not necessary that the lateral or windage adjustment of the new sight have as extended a movement as that on the rear sight of the model 1903 rifle, a movement of 0.25 in. being sufficient. If this much cannot be obtained sights that permit of a movement of 0.20 in. on either side of the zero may be submitted.

In connection with the elevation adjustment an adjustment by means of a strong micrometer screw may be submitted, but this is not necessary. If a micrometer screw is inserted it should be in addition to the ordinary slide adjustment, and the graduations thereon should read so as to permit of a vertical movement of the point of impact of 1 in. at 100 yd., 2 in. at 200 yd., and so on. In other words the adjustments should be for minutes of angle.

The lateral, or windage, adjustment should preferably be actuated by a screw as on the rear sight on the model 1903 rifle, but may be actuated by a slide and clamp. The graduations of this adjustment should be equivalent to 4 in. for every 100 yd. of range. If a screw is used to adjust, then one revolution of the screw should either move the adjustment over one graduation on the scale or over four graduations.

It is strongly desired that this new rear sight be capable of being placed on the present receiver of the model 1917 rifle without any modification of the receiver whatever; that is, it should fit between the two rear-sight guards on top of the receiver and be secured thereto by the rear-sight joint bolt. If this is not possible then the rear sight should be capable of being fitted to rifles in the hands of troops by such simple operations as could readily be made by mechanics in the field.

The cost of construction is a serious item. A satisfactory rear sight can easily be designed which will conform with all the above requirements, but its construction will be so complicated that its cost will be prohibitive. No rear sight, the cost of which is not prohibitive and which retains the present desired principle of aiming (a large aperture in a small disk), has yet been presented.

Design Desired

A design is desired in which, when the leaf is laid flat, a battle sight similar to that on the present sight is presented in position for aiming. This battle sight should be of sufficient height for firing at 300 yd.; that is, the point of impact and point of aim should coincide at 300 yd. When the leaf is turned up vertically it should permit of elevation adjustments from 100 yd. to 1500 yd. at least.

Ability of the new sight to stand rust and to be readily cleared of dust and mud are very desirable. No fragile parts should stand above the guards of the receiver. All screws used for adjustment should be strong enough to stand the handling that the soldier will give them under service conditions.

The reasons for thus writing the specifications for this new sight are as follows:

Aiming Principle—The present aiming principle as seen on the sight for the model 1917 rifle is believed to be correct. Any peep sight should be as near the eye as possible and still avoid injury to the eye from recoil. The principle of a large aperture and small disk, the Lyman sight, is correct for a military sight. Such a sight can be used for rapid fire and for fire against a poorly defined target or one in a poor light. A small aperture with a large disk is better for target shooting, but with such a sight the rifleman cannot find his target quickly if it be not in one set position as in target shooting; he cannot see to aim at poorly defined targets, nor in poor lights, and he cannot keep a moving target constantly in view.

Adjustments—The rifleman is taught to aim in a normal manner, with the top of the front sight held just below the bull's-eye, or target, at 6 o'clock. With a little practice he has impressed on the retina of the eye a picture of the sights correctly aimed. His eye retains a memory of this picture, and he is able to reproduce this picture exactly and with great accuracy in aiming. If at any time this picture is incorrect the error stands out so apparent that the rifleman is at once aware of it and corrects the error. Thus the rifleman when aiming normally aims consistently, the same for every shot, and a small group of shots results. This is accuracy. Accuracy therefore results when the rifleman is able to aim normally; that is, when with a normal aim the group of shots, that is the point of impact, will fall on the point of aim. If, however, it is not possible to bring the point of impact to coincide exactly with the point of aim, through the inability to so adjust the sights, it will be necessary for the rifleman to aim other than normally. Thus, if he is firing at 500 yd., and the rifle requires an elevation of 535 yd. and a lateral deflection of 20 in. to hit the center of the bull's-eye, and owing to the construction of the sight he can only adjust the near sight to 500 yd. elevation, and no deflection, then it will be necessary for him to aim, not normally, but about 15 in. above the bull's-eye and about 20 in. to one side. In practice he must estimate where these measurements will come on the target, and then estimate that he is holding off this much. The picture of the normal sighting that has been impressed on the retina of his eye is of no use to him. He must see his sights aligned differently practically every time he fires at any range, and if in addition a varying wind is blowing he must sight differently at every shot. It has been determined conclusively that if a skilled rifleman fire at 200 yd. a series of 10 shots with normal aim he will attain with the service rifle and good ammunition a group, all shots of which will be contained in a circle approximately five inches in diameter. If, however, instead of aiming normally he is required to aim as nearly as he can estimate 8 in. below the bull's-eye and 5 in. to its left, then his group of successive shots instead of being contained in a small circle about 5 in. in diameter will require a circle about 10 in. in diameter to contain them; that is, his error is just about doubled. We therefore see the desirability of a sight the adjustments of which are such that the rifleman can readily bring the point of impact to coincide with the point of aim at any range.

Setting Sights

It is of course known that no two rifles ever shoot exactly alike and that no two riflemen ever aim exactly alike, hence it is practically impossible to ever set the sights correct for every man or indeed for any particular man. Every rifleman must sight his own rifle.

Zero—It is impossible to set the sights for zero for any particular man or even for the average man. By means of the triangle-aiming exercises conducted at 100 yd. it has been found that when the rifle is held absolutely immovable and sights not moved that riflemen will bring a bull's-eye into line very differently. Almost every man will do it slightly differently. The maximum error among riflemen of national reputation, as determined at the Small Arms Firing School, at a range of 100 yd. was found to be about 12 in.; that is, if an attempt be made to set the sights of a rifle at zero at the armory these sights may be found to be as much as 12 in. out of correct alignment for a good shot at 100 yards.

Hand Grenades.—An improved hand grenade is wanted with the following characteristics:

Rifle Grenade—Simplicity of construction and operation; light weight (under 20 oz.); safety, sureness of explosion; long range (between hand grenade and trench mortar); no damage to rifle from use; should require no special ammunition; adaptability for use as hand grenade as well as rifle grenade; designed to secure maximum fragmentation and hold maximum amount of explosive; should not require special tromblon or discharger; detonators inserted separately.

Ideal Impact Grenade—Must explode no matter what the angle of impact; must explode on soft ground as readily as on hard ground; safety; simplicity of construction and operation; fit easily in the hand; light weight (not over 22 oz.); be adaptable for use in grenade thrower with safety; should permit rough handling; weather sound and flash proof; detonators inserted separately.

Improvement in Cable Braces for Airplanes.—The present method of attaching the ends of cables to turnbuckles and anchorages is by bending the end of a cable around a protecting liner and wrapping the overlapping end with brass wire, which is afterward soldered. This is an unsatisfactory, wasteful and expensive method. If some very simple method of anchoring cable ends could be devised it will greatly speed up the production of aircraft.

Great Meeting of War-Service Committees

Plans for assembling at Atlantic City Dec. 4, 5 and 6 all the members of the more than 300 industrial war-service committees for a great war-emergency and reconstruction conference were announced today by the War Service Executive Committee of the Chamber of Commerce of the United States.

The meeting will bring together some 3000 industrial leaders to discuss problems that have arisen since the war. National councillors of the chamber, representing more than 1100 commercial and industrial organizations which comprise its membership, will meet at the same time and place.

The purposes of the conferences will be to determine how industry may coöperate still closer with the Government through more centralized organization, probably a federation of all the war-service committees. Questions of reconstruction too will be taken up.

For nearly a year the chamber has been directing the organization of war-service committees to assist the Government in mobilizing the country's industries for the prosecution of the war. It is evident that however far away the end of the war may be it is necessary to outline a general program of organizing business for the period of reconstruction.

Industries acting individually can scarcely hope to prepare for reconstruction on the scale that will be necessary, and a federation of all the war-service committees of all the industries will be of inestimable value in working with governmental agencies that will be created to deal with this subject.

The war-service committees represent the most important and best informed body of business men ever associated for a practical and patriotic purpose, and the conference therefore will be one of the most important business gatherings ever held in this country. Certain common interests and duties that bind together all the war-service committees include:

War Industries.—To keep efficiency and production at the highest possible point through stable labor conditions and a steady flow of materials through plans, thus assuring the utmost aid in carrying out the war program of the Government.

Nonwar Industries.—To keep plant organization and production from falling below the danger line through shortage of materials, labor and transportation.

Jointly.—To face squarely the reconstruction period and to be ready through exhaustive study to lay before such governmental agencies as may be created to deal with reconstruction the necessary data bearing on the subject.

Questions foremost in the minds of business men will be discussed by the best authorities that can be assembled, the speakers who have accepted invitations to appear including Secretary of Commerce William C. Redfield, A. C. Bedford, James A. Farrell and Paul Warburg.

Matters common to all industries will be taken up and there will be sessions of committees within particular industries at which specific problems will be discussed, meetings of related war-service committee groups and conferences of individual war-service committees. National councillors of the Chamber of Commerce will also hold separate sessions.

The main conferences will be held on the Million Dollar Pier.

Guarding Against Influenza in the Shop

Among the industries of Fort Wayne, Ind., guarding against the epidemic of influenza that is now prevalent is the big oil-tank and pump works of S. F. Bowser & Co., Inc. This company has organized a health campaign for its employees as well as for the city. Stations have been installed about the different buildings, which are quickly and easily accessible to all, and every employee of the works is requested to have his or her nose and throat sprayed at least twice daily.

Specially instructed attendants are on hand at all times and the service is free, the company standing the expense. Bulletins have also been posted giving instructions on the care of the nose and throat, as the germs of influenza circulate in the air in the form of dust and naturally attack through those organs.

Deputy health commissioners have been appointed to enforce the laws of the health department to prevent the spread of the disease through spitting, coughing or sneezing. Spittoons have been removed from the plant and the workers have been cautioned against indiscriminate spitting.

Employees of the company have been instructed to report all cases to the deputies and any employee showing the slightest symptoms is sent home immediately. They are responding with a will to the treatments, realizing that everything is being done to insure their health and keep them at their tasks which are so essential in the maintenance of the war.

The Bowser scheme of precaution is a forerunner of other campaigns that are being inaugurated among the larger plants. Officials of the General Electric Works are devising plans for a similar scheme.

War Sparks from Industry's Forge

Edited by E.C.Porter

A saving of $193,750 has been effected by the Army Ordnance Department on one contract for 1,250,000 fabric gun slings. By investigation of production costs of webbing and metal parts of the slings the ordnance engineers were successful in reducing a quotation of 82c. to 66½c. a sling, saving 15½c. on each sling.

* * *

The War Industries Board has issued orders prohibiting felt mills from manufacturing felt for use in pianos during the period of the existing emergency. This action was taken because for an indefinite period to come all felt-producing machinery in the country will be needed in the manufacture of felts for the Government. In fact, according to the Felt Section of the War Industries Board, the Government's requirements of felt are far in excess of the mill capacity of the country.

* * *

A new record in the production of United States 30-caliber, model 1903 rifles has been made at the Springfield Armory by the attainment of a daily average of 1400 rifles for the first two weeks of October. A large number of spare parts is also being manufactured for repairs. Production at Springfield shows a rapid and steady increase from 60 rifles a day before our entrance into the war to 1000 a day in November, 1917, since when there has been a steady climb to the present record figure.

* * *

Nine hundred thousand dollars will be saved along with a material reduction in labor and time by the determination of the Ordnance Department to allow an alternative specification in future contracts for the manufacture of magazines for 45-caliber revolvers. About 30,000,000 of these magazines remain to be completed. Through changing the method of attaching the base of the magazine to the tube the reduction in the number of operations required has reduced the cost of production by 3c. on each magazine.

* * *

There is a very great shortage in New Zealand of all lines of hardware, according to recent reports. Within the past few days there has been a jump of $24.33 a ton in the price of wire nails that sold previous to the war at 5c. a pound or 5 lb. for 24c., while 1-in. nails are now worth 14c. a pound and 2-in. nails 18c. a pound. The prewar price of corrugated iron was $87.60 a ton; now this iron is selling at $389.32 to $437.98 a ton, and almost impossible to obtain at these figures. Ordinary 2-in. wire netting that sold prior to the war at $1.82 a roll of 50 yd. now sells at $8.15 a roll. All tools have increased in price from 300 to 400 per cent. and are difficult to procure at that. There seems to be no relief in sight unless American manufacturers can give some assistance, since hardware imports are very generally prohibited or restricted from Great Britain and continental markets.

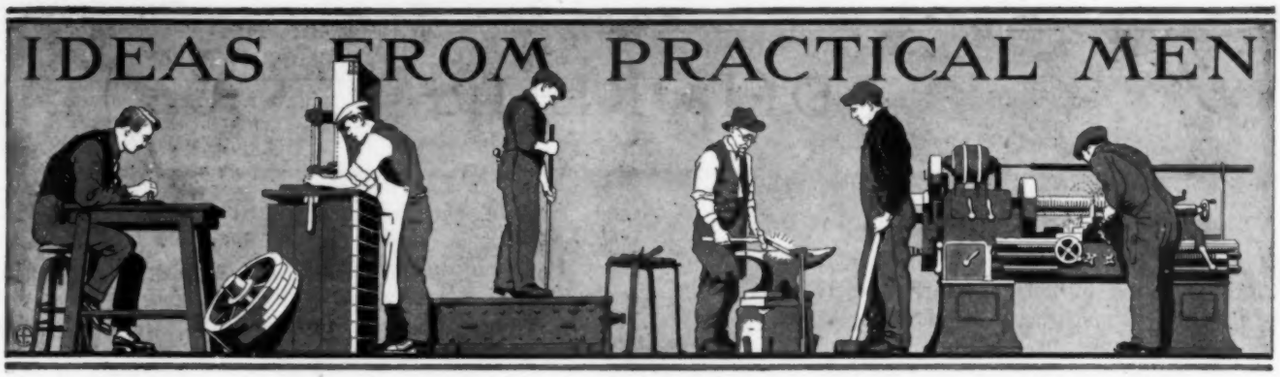
One day in October the Board of Review in the office of the Quartermaster General sanctioned purchase orders and contracts amounting to $20,621,176. Among the items included in the transactions approved on that day were: Crowbars, axes, trench mirrors, cloth, motor trucks, motorcycles, ginger, bacon, ham, cheese, nails, salmon, flour, shovels, butter, horseshoes, typewriters, paint, hay, oats, cinnamon, nutmeg, sugar, beans, catsup, evaporated milk, flannel shirts, tomatoes, screwdrivers, oversea caps, wooden wheels, tires, tents, bicycles, razors, woolen trousers, hard bread, pencils, baking powder and meat saws. This will give a fair idea of the range of commodities purchased for the Army by the Quartermaster Corps.

* * *

Five hundred and fifty rolled bayonets recently tested at the Bridgeport plant of the Remington company proved successful and satisfactory, and the Production Division of the Ordnance Department has commanded the letting of a contract for 300,000 of this new type. This rolled bayonet saves approximately 70 operations in manufacture, and when quantity production is reached it will greatly speed up the output. Bayonets as at present made require a series of operations—machining, hardening and tempering of drop-forge steel—which to a great extent are done away with by the rolling process. In addition to the saving in time there will be a material reduction in labor requirements.

* * *

The New York-Chicago air mail route will be inaugurated between Dec. 1 and Dec. 15. Cleveland has set apart for use as an air mail field Woodland Hills Park, a magnificent pleasure ground, and will place on it a hangar costing $10,000. Chicago has given the use of Grant Park as an aviation field for the landing of mail ships, and the Aero Club of Illinois has tendered the use of Ashburn Field for hangars, workshops and bunk houses for the mechanical forces. The Association of Commerce of Chicago has voted an allotment of $15,000 for the construction of an air mail hangar. Bryan, Ohio, the intermediary stopping point between Chicago and Cleveland for exchange of mail and gassing of airplanes, has furnished the Post Office Department with a suitable ground and hangar. The New York-Chicago route will be laid out in three legs, the first from New York to Bellefonte, Penn., a distance of 215 miles, with an emergency station and machine midway at Lehighton; the second leg from Bellefonte to Cleveland, a distance of 215 miles, with an emergency station at Clarion, Penn., a distance of 87 miles from Bellefonte, and the third leg from Cleveland to Chicago, a distance of 323 miles, with an intermediate mailing station at Bryan. The plan of operation during the unfavorable winter months contemplates the airplanes leaving Chicago and New York at 6 o'clock each morning, with a capacity of about 20,000 letters, and making the trip, including all stops, within 10 hours.



Tool for Laying Out Work in the Milling Machine

BY WILLIAM FAIRFULL

The sketch shows a device which I find very helpful in laying out work on the milling machine where a series of holes is to be located at different points. The body of the tool has a hole to fit the arbor of the milling machine, and at a right angle thereto is a smaller hole to which is fitted a small prick punch held

TOOL FOR LAYING OUT WORK IN MILLING MACHINE

in position by a collar and spring as clearly shown in the sketch. To use the tool it is clamped tightly on the arbor in the same manner as a cutter, care being taken to have the body set square with the table. Fasten the die blank to the milling-machine table and spot the center. Then by means of the indexes on the traverse and cross-screws any number of holes can be laid out in quick time and to good advantage.

Indexing Device for Relieving Multiple-Threaded Hobs

BY ROLAND V. HUTCHINSON

Some months ago I had occasion to make a number of multiple-threaded hobs, and to simplify the work the tools shown in the drawings were made and arranged to fit a 16-in. Hendy-Norton lathe.

Fig. 1 shows the assembly of an indexing driver.

The body *A* is arranged to bolt on the faceplate of the lathe. A circular plate *B* fits into a recess in the body and is held by three clamps *C*. Upon this plate are two projections *D* fitted with setscrews, which serve to hold the tail of the dog firmly in relation to the driver.

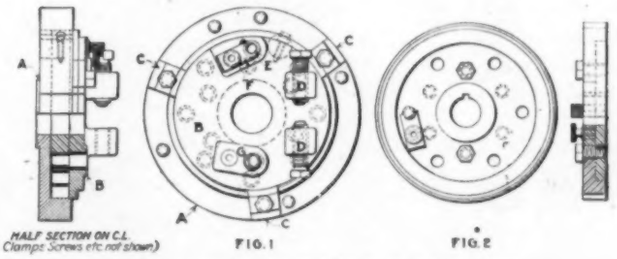
Two circles of index holes fitted with hardened-steel bushings are made in the bottom of the recess and a hole is made in the indexing plate to correspond with each circle. An index pin *E* is held in place by a flat steel spring *F* and may be changed from the position shown to position *G* when it is desired to use the inner circle of holes.

The indexing change gear shown in Fig. 2 is similar in principle to the driver.

These tools, properly used, save no end of trouble and delay. One of the essential points in relieving multiple-threaded hobs is that when the hob is indexed from one line of teeth to the next it is also necessary to adjust the relieving gears to correspond to the amount of movement given the hob. The indexing change gear takes care of this, as it is put on as a first driver in the train in a most accessible position.

We find that for extreme accuracy the gash should be cut exactly at right angles with the angle of the thread helix and relieving gears figured to suit the actual lead of the gash; also that on gash leads of 8 in. and longer $\frac{1}{32}$ in. variation in leads makes little difference, but if an approximation to the true lead be made the backing-off gears must be figured to suit the actual and not the theoretical lead.

The formula used for figuring gash lead and backing-off train are the regular ones recommended by the



FIGS. 1 AND 2. INDEXING MECHANISM

Hendey-Norton Co. in its booklet, and in the case of prime numbers being encountered I found the use of the logarithmic table published on page 1080, Vol. 43, of the *American Machinist* very helpful.

Hobs should be remilled on the face of the teeth after relieving, hardened, and then ground on the faces with a wheel no larger in diameter than the cutter with which the gashes were milled.

This last specification is a most important one, as I have seen many cases of multiple-threaded hobs ground with 6-in. saucer wheels which were much too large, the interference of the large wheel with the teeth adjacent to the one being sharpened causing the face of the tooth to lean back and thereby causing the hob to generate an inaccurate tooth form.

A leader of the same lead as the gash should be used when grinding, and the finger on the grinding machine should bear on the teeth of the leader.

EDITORIALS

The Spirit Behind the Guns

DURING the last 40 years the Germans have spent billions and billions of marks for the upbuilding of a military machine, but they have neglected to invest their money in the upbuilding of morale. As a result their tremendously efficient war machine is crumbling to pieces before the hastily constructed military machinery of the Allies.

If you have watched a machine gun spraying its bullets at the rate of 600 a minute and swinging from side to side so as to sweep the ground with a curtain of fire, you would have wondered how American soldiers day after day and in instance after instance have defied this rain of steel and advanced to the very muzzle of these guns. Every time you pick up a paper it is a common occurrence to read of the capture of a German machine gun by American infantry.

A machine gun with its terrible rapidity of fire, as an instrument of destruction, is far more formidable than are 10 infantrymen armed with service rifles. But the American infantryman wins out against the machine gun because he has morale and the German machine-gun operator has not. It is just as much a part of our job to supply the morale for our boys as it is to supply them with guns and ammunition or with transportation.

The seven war-work societies, which comprise the Young Men's Christian Association, the Young Women's Christian Association, the National Catholic War Council, the Jewish Welfare Board, the American Library Association, the War Camp Community Service and the Salvation Army, are doing wonders by carrying cheer and a taste of home to the boys who do the fighting.

A national campaign is now starting to raise the sum of $170,500,000 for continuing the morale work of these organizations. It is known as the United War Work Campaign. The Government takes charge of dividing the proceeds among the seven societies. By combining the drive for these seven organizations the cost and effort of six additional campaigns is saved.

With these dollars these seven societies will provide 3600 recreation buildings, 1000 miles of motion-picture film, 100 leading stage stars, 2000 athletic directors, 2500 libraries supplying 5,000,000 books, 85 hostess houses, 15,000 big-brother "secretaries" and millions of dollars of home comforts. And when the boys come back from the line with their minds full of pictures that refuse to fade, these minds will be cleansed of every worry and peace come to those who have been so burdened with their memories.

The man in the shop who sticks by his machine in spite of fatigue deserves your support and my support and your admiration and my admiration. The man in the front-line trenches who, armed with rifle and bayonet, faces the Hun in a life-and-death struggle is pinnacled in our hearts as an American hero. But how about the soldiers of cheer who unarmed crawl over the deadly surface of No Man's Land, bearing with them bars of chocolate, cigarettes and letters from home? Here is where our $170,000,000 are going. Here is an investment that will not give you a Government bond as security, but will bring you in interest at 100 per cent. for the rest of your life. Go to it!

Daylight Saving's First Trial

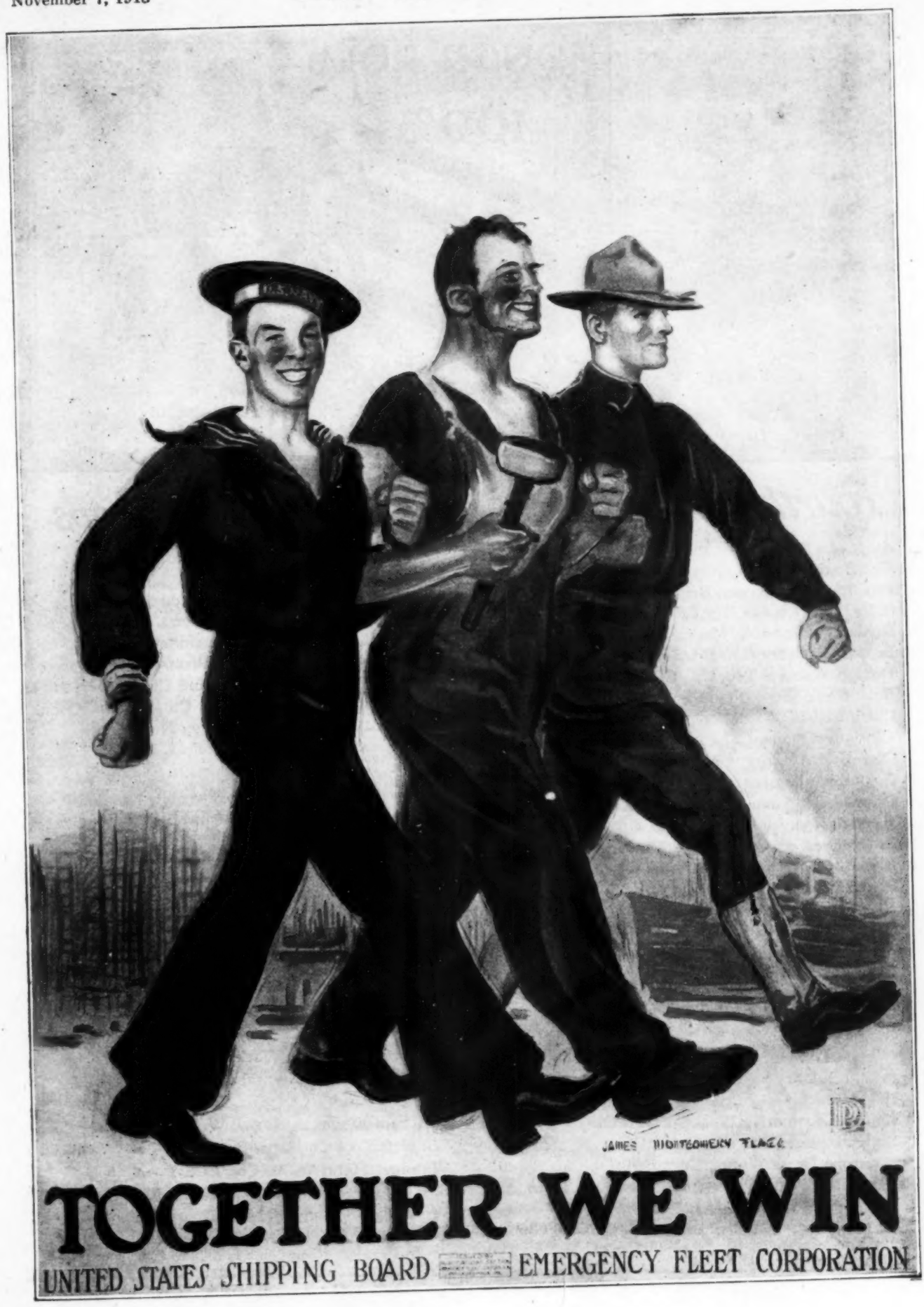
THE daylight-saving plan inaugurated in this country last March and which came to a close on the 27th inst. has had its first trial. Like every undertaking the project had a credit and a debit side which could be translated into terms of measurement that should show either profit or loss.

Obviously the effect of the scheme manifested itself most prominently in the saving of artificial light. The Washington (D. C.) Gas Light Co. has estimated from figures it had collected that the people of the District of Columbia saved $60,000 in their gas bills, and on this basis the conservation of this commodity would amount to $2,000,000 for the whole country. In the matter of gas and electricity, the saving was not less than 10 per cent. of the money formerly spent for them.

What was the loss of the lighting companies, however, was the nation's gain, as the additional hour of daylight opened up numerous opportunities that redounded to the people's benefit physically and materially. Artificial light is inseparably bound up with fuel, and fuel means coal. The saving in this essential article alone amounted to 1,250,000 tons, according to the Fuel Administration. The coal saved in this direction was diverted to the supplying of industries engaged in making machine tools and munitions, building ships and other manufactures equally important. In this connection the War Industries Board deemed the innovation so successful as a coal conserver that it urged its continuation to the end of the war, Congress nevertheless adhering to the original proposition.

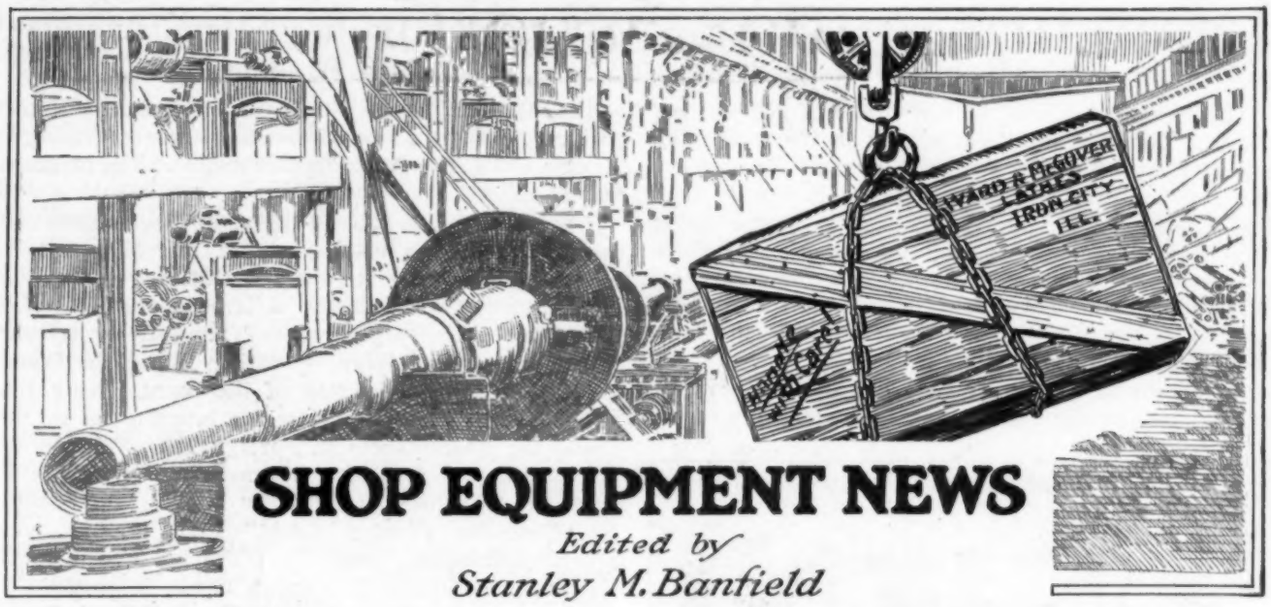
Another effect of the good emanating from daylight saving was the impetus it gave to agriculture. Charles Lathrop Pack, president of the National War Garden Commission, gave out a statement in which he said that the war-garden plots laid out this year numbered 5,285,000, the yield of which in the value of their crops amounted to $525,000,000—more than half again the value of the 1917 produce from the same source.

The success of daylight saving from the material side, however, is hardly greater than the physical benefit it conferred on the people of this country, which incidentally was the last of the great nations to adopt the measure, for it might be said that as it added one hour to the length of the day it also added months to the lives of those who took advantage of it in recreation for mind and body. Altogether the scheme was worth the trial, and no doubt it will be resumed without trepidation when the longer days return.


JAMES MONTGOMERY FLAGG
TOGETHER WE WIN
UNITED STATES SHIPPING BOARD EMERGENCY FLEET CORPORATION

Fourth Liberty Loan in American Machine Shops

American Brake Shoe and Foundry Co., Erie, Penn.
Ball Engine Co., Erie, Penn.
Bay State Iron Works, Erie, Penn.
S. F. Bowser & Co., Inc., Fort Wayne, Ind.
Bullard Engineering Works, Bridgeport, Conn.
Bullard Foundry Co., Bridgeport, Conn.
Bullard Machine Tool Co., Bridgeport, Conn.
Bury Compressor Co., Erie, Penn.
Cincinnati-Bickford Tool Co., Cincinnati, Ohio.
Cincinnati Planer Co., Cincinnati, Ohio.
Cleveland Automatic Machine Co., Cleveland, Ohio.
Columbian Hardware Co., Cleveland, Ohio.
Crossley Lead and Machine Co., Erie, Penn.
H. C. Dodge, Inc., Boston, Mass.
Enterprise Co., Columbiana, Ohio.
Erie-Buffalo Tube Co., Erie, Penn.
Erie Car Works, Erie, Penn.
Erie City Welding Co., Erie, Penn.
Erie Machine Shops, Erie, Penn.
Erie Tool Works, Erie, Penn.
Erie Welding Co., Erie, Penn.
Fawcus Machine Co., Pittsburgh, Penn.
Germann Bronze Co., Erie, Penn.
Giddings & Lewis Manufacturing Co., Fond du Lac, Wis.
Gurney Co., Honesdale, Penn.
Frederick Hart & Co., Poughkeepsie, N. Y.
Heald Machine Co., Worcester, Mass.
Heisler Locomotive Works, Erie, Penn.
Kelley Reamer Co., Cleveland, Ohio.
Keystone Brass Works, Erie, Penn.
Lake Erie Welding and Spring Co., Erie, Penn.
Lawrence & Hill, Inc., Watertown, N. Y.
W. B. Marvin Manufacturing Co., Urbana, Ohio.
McIntosh & Seymour Corp., Auburn, N. Y.
Metric Metal Works, Erie, Penn.
Meyer-Moran Co., Baltimore, Md.
Modern Pattern Works, Erie, Penn.
Morris Machine Tool Co., Cincinnati, Ohio.
National Foundry Co., Erie, Penn.
National Woodworking Machine Co., Dover, N. H.
New London Ship and Engine Co., Groton, Conn.
New York Machinery Exchange, New York.
Niles-Bement-Pond Co., Plainfield, N. J.
Oldham New York Saw Works, Brooklyn, N. Y.
Parker White Metal Co., Erie, Penn.
Perry Iron Co., Erie, Penn.
Plymouth Cordage Co., North Plymouth, Mass.
Reed Manufacturing Co., Erie, Penn.
Rickert-Shafer Co., Erie, Penn.
Rochester Motor Co., Rochester, N. Y.
Shambow Shuttle Co., Woonsocket, R. I.
Skinner Engine Co., Erie, Penn.
Triangle Tool Co., Erie, Penn.
Union Iron Works, Erie, Penn.
U. S. Ball Bearing Manufacturing Co., Chicago, Ill.
U. S. Horseshoe Co., Erie, Penn.
Van Atta Aluminum Works, Erie, Penn.
Victor Tool Co., Waynesboro, Penn.
Walker Foundry Co., Erie, Penn.
Waltham Machine Works, Waltham, Mass.
Williams Tool Co., Erie, Penn.
Wire and Metal Wares Co., Erie, Penn.
S. H. Woods Machine Co., Boston, Mass.
Worthington Pump and Machinery Co. (Deane Works) Holyoke, Mass.

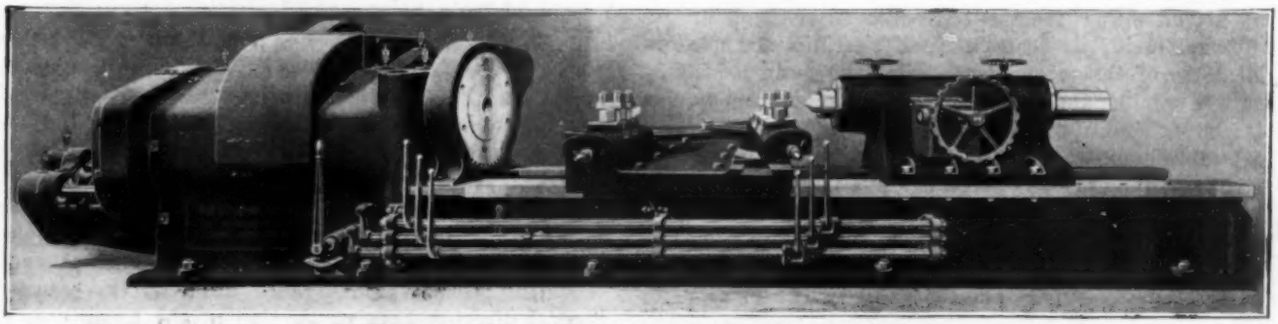


SHOP EQUIPMENT NEWS

Edited by
Stanley M. Banfield

Amalgamated Shell-Turning Lathe

The Amalgamated Machinery Corporation, 72 West Adams St., Chicago, Ill., has recently brought out the No. 47 shell-turning lathe shown in the illustration. It is designed for turning shells ranging from 12 to 20 in. in diameter. The headstock is cast integral with the bed and an arm is bolted on for supporting the end of the belt-drive pulley shaft. For rapid traverse and reverse a secondary pulley is provided. All-steel gears are used throughout the machine, four spindle speeds being incorporated. There are two driving gears on the spindle, giving a double pinion drive, the teeth of the pinions being staggered to improve the driving qualities. It is also claimed that the double gears on the spindle, one at the front and the other at the rear, keep the bearing from wearing bell-mouthed. The lead screw extends through the center of the lathe bed and the carriage is made in two parts, the lower, being known as the master carriage, running on the lathe bed; this carries the tool carriage, which can be changed when shells of different size are handled. A feature of this design of carriage is that it simplifies the design of the machine and makes it possible to change easily from one size of work to another. A new type of profile-turning attachment for the nose of the shell has been embodied in the design. The profile attachment, called the "cam," is bolted to a bracket on the back of the bed, and in it run two double cam blocks which swing the profile toolpost so that the tool is always cutting at an angle of 90 deg. to the line of cut. This gives the same relative position between the cutting edge and the work at all points. The lower portion of the tool carriage moves only at right angles to the line of the lathe bed, the upper portion swinging with the motion or the cam. Owing to the special design of these large shells the toolpost next to the headstock has been designed for straight or taper turning by means of a profile attachment in order that it may turn the flare on the end of the shell if this is required. The rapid traverse in either direction is provided with a double clutch control, and one set of feeds and speeds is provided for each size of shell. The four speed changes in the headstock are controlled by the single lever, and the feeds are changed by changing the gears. A double-lever system is used for the various clutch controls, this being clearly shown on the front of the machine. The levers at the tailstock end of the machine are mounted in a housing which may be moved lengthwise of the lathe so that the operator may change the position of these as most convenient. The bed is fitted with square gibs, and the faceplate is drilled for bolts. The tailstock is bolted in position as shown, various positions being provided for.

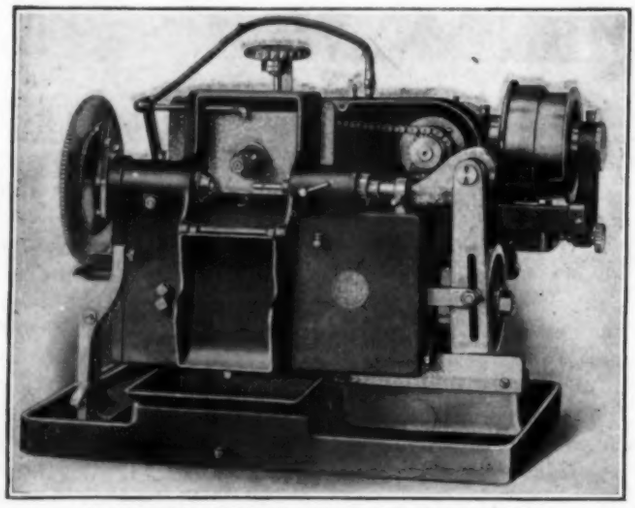


AMALGAMATED NO. 47 LATHE FOR SHELL TURNING

Floor space, 29 ft. 8½ in. by 5 ft. 3 in.; height, 6 ft. 8 in.; diameter of main pulley, 16 in.; face of main pulley, 12 in.; diameter of pulley for rapid traverse, 16 in.; width of pulley for rapid traverse, 6 in.; speeds, four; gear ratios, 27.3, 31.3, 36.1, and 42 to 1; feeds, 0.070 to 0.50 in. per spindle revolution.

Waltham 4-In. Spur-Gear-Cutting Machine

The illustration shows the new 4-in. spur-gear-cutting machine that has just been placed on the market by the Waltham Machine Works, Waltham, Mass. The new machine has been made considerably heavier than the old one, and the positive chain drive on the cutter spindle prevents damage to the cutter, work or machine on account of slippage. The work is completely inclosed during the operation of cutting, a feature that protects the working parts of the machine from oil and chips. The guards have been removed from the machine shown in the illustration in order to show the details more clearly. All speeds, feeds, indexing of the



WALTHAM SPUR-GEAR-CUTTING MACHINE

Largest pitch diameter of work, 4 in.; coarsest pitch cut, 16; speed of countershaft, 675 r.p.m.; diameter of tight and loose pulleys, 6 in.; width of belt, 2 in.; size of pan base, 28 x 18 in.; weight, 610 lb.; weight of countershaft, 65 lb.; diameter of cutter arbor, ½ in.; standard dimensions of cutter, 1¼ in. diameter, 0.20 in. thick, with ½-in. hole; largest cutter that can be used with full capacity of the machine, 1⅝ in.; diameter of index, 10 in.; standard number of divisions in index, 120; divisions obtained with 120 index, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120; strokes cut with No. 1 cam, 0.5 to 0.8 in.; strokes cut with No. 2 cam, 1.1 to 1.75 in.; strokes cut with No. 3 cam, 1.87 to 3 in.

work and the operation of the geared pump are obtained from a shaft carrying a two-step cone pulley which may be driven either from a countershaft or from an individual motor as desired. Ball bearings are used in all parts of the mechanism except the main camshaft, cutter spindle and work spindle. The cutter spindle is driven by a silent chain and the two sprockets are interchangeable, so that in connection with the two-step cone pulley four speeds are available. The indexing mechanism is controlled by a one-revolution camshaft, which is inoperative while the cut is in progress. During the process of indexing, the pawl is held clear of the index and only allowed to drop into place when the index notch reaches the required position. The cutter slide is also clamped securely during the cutting process, the clamp being released and the slide lifted during the return of the work slide and the indexing of the work.

After the last cut is completed the machine is stopped with the cutter lifted, and in the best position for the insertion of the new blanks, by an automatic adjustable brake that is placed on the driving cone pulley for this purpose.

Meeting of American Manufacturers' Export Association

The ninth annual convention of the American Manufacturers' Export Association was held at the Waldorf-Astoria Hotel, New York, Oct. 30 and 31. The program was as follows:

Wednesday, Oct. 30.—9-10 a.m.—Registration of members. 10-12 a.m.—Reports of officers and committees; amendments to the constitution; election of officers, and new business. Afternoon Session.—12-2 p.m.—Registration of guests. 2 p.m.—General topic, "Financing Our Foreign Operations After the War," Louis E. Pierson, chairman of the board, Irving National Bank, chairman of session; introduction by the chairman; "Acceptances in Foreign Trade," Lawrence M. Jacobs, vice president International Banking Corporation; "Facilities of American Banking Institutions for Financing Foreign Trade," Fred I. Kent, vice president Bankers' Trust Co.; "Foreign Credit, With Particular Reference to Foreign Credit Facilities," J. H. Tregoe, secretary National Association of Credit Men, New York; "The Extension of Foreign Credit," E. A. De Lima, president Battery Park National Bank. 4 p.m.—General topic, "Education for Foreign-Trade Service," W. W. Nichols, Allis-Chalmers Manufacturing Co., chairman of the session; introduction, "Some Fundamentals in Training," W. W. Nichols; "Foreign-Trade Service in the Present Emergency an Essential Service," M. A. Oudin, foreign manager General Electric Co.; "Our New Foreign Representative," Frank H. Taylor, president S. S. White Dental Manufacturing Co.; "How Can Business Train for Foreign Trade?" H. E. Cole, Standard Oil Co. of New York; "What the United States Bureau of Education Is Doing and Can Do," Glen Levin Swiggett of the United States Bureau of Education; "The Educational Facilities in Our Training Camps," a representative of the Commission on Training Camp Activities; "American Representatives for American Goods," George E. Smith, president Royal Typewriter Co.

Evening Session Devoted to Foreign Advertising

General topic, "Foreign Advertising," H. L. Gemperling, Sherwin Williams Co., chairman of the session; "Why Advertise Abroad?" D. L. Brown, manager export division, Advertising Department of the Goodyear Tire and Rubber Co.; "Direct Advertising Abroad," H. B. Gregory, president Export Managers' Club of New York; "Various Methods of Foreign Advertising," C. H. Green, advertising manager Federal Export Corporation; "How the Advertising Agency Can Help," E. M. West, Calkins & Holden Advertising Agency; "Creating Good-will Abroad," Carl Byoir, associate general director Foreign Section of the Committee on Public Information. 9 p.m.—General topic, "Patents and Trademarks," C. W. Beaver, manager Foreign Department of the Yale & Towne Manufacturing Co., chairman of session; "Foreign Trademarks, the Present and the Future," Lawrence Langner, member Patent and Trademark Committee of the association; "Private and National Trademarks," C. W. Beaver; "Patent and Trademark Improvements," Dr. F. E. Stewart, H. K. Mulford Co.; "Inequalities in Trademark and Patent

Laws," E. B. Hess, vice president Royal Typewriter Company.

Thursday, Oct. 31.—Morning Session.—10 a.m.—"A Genuine Department of Commerce," Hon. B. S. Cutler, chief Bureau of Foreign and Domestic Commerce; "The Relation of Government to Foreign Commerce," H. C. Lewis, general manager National Paper and Type Co.; "Commercial Treaties and Trade Agreements Incident to War, Peace and Reconstruction," Frederick B. Whitney, president Deselektro Company.

The morning session closed with a practical demonstration of an export order by Frank Waterman and staff of the L. E. Waterman Company.

Afternoon Session

Afternoon Session.—2 p.m.—General topic, "Our Ships After the War," H. C. Matlack, president Matlack Coal and Iron Corporation, chairman of the session; "Our Mercantile Marine," (a) Frank B. Mackey, vice president Barber Steamship Line, and (b) Joseph Hodgson, traffic manager New York & Cuba Mail Steamship Co. (Ward Line); "How Shall We have a Real Merchant Marine?" Joseph J. Slechta, traffic manager Gaston, Williams & Wigmore Shipping Corporation; "The Urgent Need of Port and Terminal Improvements," John Meigs, Harriman Steamship Line; "Our Ships After the War, the Manufacturers' Viewpoint," E. M. Herr, president Westinghouse Electric and Manufacturing Co. 4 p.m.—General topic, "Sales Organization Abroad," C. J. Warren, manager Foreign Department of the Johns-Manville Co., chairman of the session; introduction by the chairman; "The Development by a Manufacturer of a Foreign Sales Organization," (a) John F. McClain, vice president Remington Typewriter Co., and (b) William Ingersoll, Robert A. Ingersoll & Bros.; "The Export Merchant," J. F. Fowler, vice president W. R. Grace & Co.; "How Different Types of Selling Organizations May Obtain the Benefits of the Webb-Pomerene Law," Gilbert H. Montague of the New York Bar; "The Webb-Pomerene Law as It Is Being Administered," Hon. John Walsh, chief counsel Federal Trade Commission.

Evening Session

Evening Session.—Banquet in the grand ballroom of the Waldorf-Astoria, 7:30 p.m. The speakers were: Sir Henry Babington Smith, K.C.B., Acting High Commissioner for Great Britain; a representative of the French government; Hon. William C. Redfield, Secretary of Commerce; Hon. Edward N. Hurley, chairman of the Shipping Board; Hon. Herbert Bayard Swope, member of the War Industries Board, assistant to the chairman of the board; Frank A. Vanderlip, president of the National City Bank, and the Hon. Martin W. Littleton.

Recent Changes Made in the Ordnance Department

Brig.-Gen. W. S. Peirce, head of the Administration Division of the Ordnance Department, has been appointed Assistant Chief of Ordnance, and as such will have general administrative charge of the ordnance office and will act for the Chief of Ordnance, Maj.-Gen. C. C. Williams, during his absence. General Peirce will be succeeded as head of the Administration Division by Col. W. W. Gibson, who will also continue his duties as Director of Ordnance Training. Colonel Gibson acted in this capacity during the recent absence of General Peirce overseas.

Brig.-Gen. C. C. Jameison, head of the Production Division, has been appointed a special assistant to the Chief of Ordnance in charge of artillery ammunition metal components, but not loading plant operations, to succeed T. H. Symington, resigned.

Col. Earle McFarland has been appointed a special assistant to the Chief of Ordnance in charge of drop bombs and trench-warfare material except explosives, propellants and loading operations.

Procurement Division

Brig.-Gen. John H. Rice, formerly Chief of the Engineering Division of the Ordnance Department, has been appointed Chief Ordnance Officer of the American Expeditionary Forces. General Rice is succeeded by Brig.-Gen. G. W. Burr as head of the Engineering Division.

Col. J. C. Heckman has been appointed Chief of the Supply Division to succeed Col. Thales H. Ames, who has been detailed for duty overseas.

Brig.-Gen. Samuel McRoberts has been relieved from duty as Chief of the Procurement Division and is succeeded by Lieut.-Col. Robert P. Lamont. General McRoberts, who in civil life was executive manager of the National City Bank of New York, is to undertake important work on the staff of the Chief Ordnance Officer with the American Expeditionary Forces in France Lieut.-Colonol Lamont in civil life was president of the American Steel Foundries Co., Chicago. He was commissioned Feb. 4, 1918, and has been at the head of the Raw Materials Section of the Procurement Division.

The Ordnance Department also announces the abolishment of the Production Division as a separate organization and the distribution of its functions among the other divisions of the Ordnance Department.

Work of Production Division Transferred

All of the work formerly done by the Production Division in Washington will now be performed by the office of the Chief of Ordnance under the supervision of the appropriate special assistants to the Chief of Ordnance. For example, the Cannon Section, charged with the production of guns and their carriages, will report to the assistant to the Chief of Ordnance in charge of cannons, carriages, their appurtenances and accessories; similarly the Small Arms Section, which is responsible for the production of small, automatic and side arms, will report to the assistant in charge of automatic arms, rifles and their ammunition.

Work previously performed by the Production Division in the field will be taken care of by the district ordnance chiefs, of whom there are 12 located in the following centers: Boston, Bridgeport, New York, Rochester, Philadelphia, Pittsburgh, Cleveland, Detroit, Cincinnati, Chicago, St. Louis and Toronto (Canada).

The service-function sections of the Production Division, such as administration, industrial service, plant and miscellaneous, as well as the general activities of the district offices, are under the jurisdiction of Brig.-Gen. Guy E. Tripp, special assistant to the Chief of Ordnance.

LATEST ADVICES FROM OUR WASHINGTON EDITOR

Washington, D. C., Oct. 26.—When we read in the morning paper about a heavy barrage being laid down or how our artillery searched out and destroyed the opposing battery few of us know how much of an engineering problem this is. In fact, we are very apt to think of it as a sort of press-the-button proposition, not realizing the amount of training necessary to make a good artillery officer.

Some idea of the extent of this training and also the necessity for men of intelligence may be had by a brief survey of the work that is being done at the Coast Artillery School at Fort Monroe, Va., which furnishes the regiments to man the guns of 6-in. caliber and above as well as the large howitzers. Every Saturday 200 new men are taken into this school for a three-months' course, and when this is satisfactorily completed they are commissioned as second lieutenants. If more than 200 present themselves the surplus is put in a "reservoir" company and given military training and some instruction in elementary mathematics. But as the average candidate will be in this reservoir company for about only ten days it is essential that he have a thorough working knowledge of trigonometry and logarithms. The three-months' training includes work on all of the different guns and howitzers, including the handling of the piece in each case. There are also courses in orientation, gunnery, gas defense and administration, while infantry drill and calisthenics form a part of each day's work.

Strange as it may seem this course does not require an enginering education or any particular technical training, although both are a distinct asset to have. Some of the best records have been made by lawyers and business men without previous experience. Summed up in the language of the commanding officer it requires the proper spirit, the proper mental attitude, ordinary intelligence, hard work and a full day's work each day. These officers have a twofold duty—first, to be able to command troops, and, second, to be able to have a high percentage of hits with their batteries.

This school is particularly well equipped with both matériel and personnel. Those in charge have been on the western front and know what should be taught. Every month instructors are sent back from the American Expeditionary Forces to keep the work up to the standard demanded by General Pershing. The land target range is located at Camp Eustis on the James River near by, so that each graduating group can receive practical instruction in firing before going to its organization.

In order to give everyone who is ambitious enough to desire such training a chance, but who is not sufficiently well grounded in mathematics and who had not the opportunity for study, a preliminary course has been arranged running from two to six weeks to fit him to enter the school and by hard work to gain a commission. This makes it a thoroughly democratic institution, which it should be.

No War-Industries Badge

After weeks of consideration and many conferences the Industrial Insignia Service of the Department of Labor announces that the plan to issue a war-industries badge has been abandoned. The general belief is that this is a mistake and that there has been a fumbling of the ball in some departments. There has been, I am sorry to say, evidence of dissension in the various committees of the Department of Labor and some instances where both individuals and committees have failed to take a broad view of the situation. Whether the dissensions caused by these narrow views were responsible for the abandonment of the plan is not known.

One of the proposals was that the button should only be issued to workers in shops complying with every regulation of the Labor Department, which on its face was an unfair proposition, for no matter how desirable it might be to have shop conditions uniformly good, and no matter how much we may condemn the employer who does not provide proper conditions, the fact remains that as long as war contracts are placed in shops of this kind every worker in them is entitled to a badge showing that he is engaged on essential war work. It is certainly no fault of the employee, who would naturally much prefer proper conditions, and it is decidedly unfair to deny him a badge of honor on this account.

Much has been done, and rightly, to see that war contracts are not placed in shops that are unsanitary or that do not have proper working conditions, but when for any reason such a contract is placed the war worker should not be the one to suffer thereby, and those who hold the opposite view can hardly claim admittance to the broad-minded class.

The Department of Labor can and should be an important branch of the Government. How important it becomes depends almost entirely on the caliber of its personnel. Too much care cannot be taken to have men of broad vision, great force of character and enough diplomacy to handle all situations tactfully as they arise. Fortunately we have some men of this description, particularly in the War Labor Policies Board. Unfortunate-

ly all of the officials of the department itself do not come under this head, and the sooner thoroughly competent men are obtained the better for all concerned.

One of the phases of the work of the Ordnance Department which is not generally known is that done by Capt. C. R. Dickinson in stimulating industry in ordnance plants. The idea behind the movement is to bring home to the individual, whether employer or employee, that his labor has a direct bearing on the outcome of the war. This work now extends to over 2000 plants, each of which appoints one man who is responsible for the proper display of posters and other printed matter.

In addition to this moving pictures have been used to show how the work is done in other plants and the use to which the various war materials are put on the other side. This branch has also urged the use of speakers in various plants, and experience indicates that such speakers should be carefully controlled, as the ordinary spellbinder is apt to do more harm than good, as he does not understand working conditions or the psychology of the employee.

It is generally believed that the best men to speak to employees are returned soldiers, preferably noncommissioned officers and privates; but in any case men who have actually been on the other side and faced the dangers of battle can make an appeal for production which no one who has not seen the war at close quarters can do.

The foreigners in our shops must also be carefully considered; for example, in plants employing men of the Czecho-Slovak race, a speaker in their language can show them that every effort put into their work is helping to destroy the Hapsburg dynasty. These people have seen their schoolhouses burned to the ground to force them to send their children to German schools, and when they can be made to realize that they are really fighting against such oppression more and steadier production will be obtained. At the same time this plan will help to educate those employers who do not realize the racial aspirations of men and women of foreign birth; it will tend to reclassify them in the eyes of such employers and bring about a feeling that cannot fail to be beneficial.

Industrial Cities Advertise Themselves

A case of industrial cities advertising their benefits which is interesting is that of the city of Hamilton, Ohio, which published 24 full-page advertisements in the daily papers calling attention to the advantages of that city and showing how the promise of a few cents more an hour in neighboring towns, the living conditions in which were unknown, might prove a bad move for those workers who jump at the offer. The advertising was paid for by the business men of Hamilton, the copy being written by the industrial division of the Ordnance Department. It resulted in a large reduction of labor turnover. Advertising of this kind can do much to arouse legitimate local pride, stimulate production and make better citizens in times of peace as well as war.

In all this work care has been exercised to keep carefully away from everything over which there is a dispute. Yet there has never been any attempt to let the waving of the flag or any patriotic appeal whatever take the place of decent housing conditions and proper working hours. In fact this service has been withheld from the wrong kind of employer, in whose shops conditions were not as they should have been, and he has invariably been told that only when they were altered could he have the benefit of this service.

This is one of the many activities brought about by the war which should be continued in a somewhat modified way and perhaps under entirely different auspices in times of peace. Work of this kind, when handled intelligently and on a broad basis, can do much to increase efficiency in all our industrial centers and make better citizens of both employer and employee. Captain Dickinson is to be congratulated on the work he has already accomplished in this connection.

Railway Work in Brazil

While the war has affected the economic development of various parts of South America in a number of vital ways it is probable that no industry has been influenced more than the Brazilian railroads. With an area and population nearly three times as large as Argentina's, Brazil has only about three-fourths of the railroad mileage of the former country. This means that there is great room for expansion and that we may look forward to a great extension of the railroad system of Brazil soon after the end of the war.

With this extension and also the rehabilitation of the present systems, for most likely the railroads of Brazil are badly run down, there must inevitably be a field for large quantities of machine tools in that country. Just how large a market this will be, or whether it will be supplied by the United States or Great Britain, cannot be predicted with accuracy, but machine-tool builders whose products can be used by railroad shops should bear this market in mind if they desire business of this character.

The Good News from the Front

The news from the front continues to be most encouraging, and we all feel a personal pride in the knowledge that some of the boys are from our shop or office if not from our family. Every man in the shop must realize that the good work that is being done would be impossible without the product of the machine shops which are either making munitions or are the necessary machines for their production.

We are proud of them, and justly so, but in our enthusiasm we should not forget that the armies of our allies had done a tremendous work in opposing the great German war machine until the American army could get over and help put on the finishing touches. No one questions that we are to be the deciding factor, but without the sacrifices that were made by our allies all of our preparation would be of little avail. We must therefore be very careful not to let our enthusiasm or our pride in the work of our boys over there lead us to say or even to think anything that might reflect upon the great accomplishments of the armies of the other Allied nations. We have accomplished the impossible in many things, but we should remember that many of the sacrifices made by the war-worn men of the other nations and the battles that are now raging on the soil of France might have been transferred to our own country but for the British navy and the armies of our allies.

Personals

R. S. Wilbur is now assistant professor of mechanical engineering in Lafayette College, Easton, Penn.

David F. Atkins is now with the Lord Electric and Lord Construction Co., New York, as mechanical engineer.

H. D. Megary has been made secretary of the Chicago Pneumatic Tool Co., Chicago, Ill., succeeding **W. B. Seelig**, who resigned.

F. H. Rosencrants is now mechanical-equipment inspector of the American International Shipbuilding Corporation, Hog Island, Penn.

John G. Schabert has been promoted to the position of assistant chief engineer of the Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn.

E. J. Heinen, formerly with the Strong and Scott Co., Minneapolis, Minn., is now efficiency engineer of the Minneapolis General Electric Company.

W. J. McDowell, formerly of the McDowell-Stocker Co., has become manager of the machine-tool department of the Fairbanks Co., 64 E. Lake St., Chicago, Ill.

Albert P. Leonard, assistant chief engineer, Honolulu Iron Works Co., New York, is now with the engineering division of the Bureau of Aircraft Production, Dayton, Ohio.

Charles J. Simeon, formerly with the Curtiss Aeroplane Co., Buffalo, N. Y., has taken the position of employment manager of the Morgan Construction Co., Worcester, Mass.

Arthur J. Coldwell, at one time superintendent of the Coldwell Lawn Mower Co., Newburgh, N. Y., has taken the position of production engineer in the Ordnance Department, U. S. A., New York.

Frank Sawford, formerly chief engineer of electrical and mechanical operations in the Canadian Collieries, Union Bay, B. C., Canada, is now with the Taylor Engineering Co., Ltd., Vancouver, B. C., Canada.

Arthur B. Coates has resigned as instructor in mechanical engineering at the University of Idaho, Moscow, Idaho, to become connected with the experimental-engineering department of the Ford Motor Co., Detroit, Mich.

G. L. Hanson has purchased an interest in the Advance Machinery Co., Van Wert, Ohio, manufacturer of milling cutters, reamers, small tools, etc., and has become a director of the company. He is now manager of the company.

Alexander Vallance is now in the shell department of the American Machine and Manufacturing Co., Atlanta, Ga. He was assistant professor of experimental engineering, Georgia School of Technology, Atlanta, Ga.

Walter F. Jay has left the Power Specialty Co., Dansville, N. Y., where he was works manager for 13 years, to become production engineer in the Production Division of the War Department at the Rochester District Ordnance office.

Walter E. Wollheim has resigned from the engineering department of the Nathan Manufacturing Co., Flushing, L. I., to assume the duties of president and mechanical engineer of the Alloy Foundry and Machine Corporation, New Rochelle, N. Y.

George D. Reynolds recently resigned as machine designer at the Edgewood Arsenal, Baltimore, Md., to take the position of works manager of the Quickwork Co., St. Marys, Ohio, manufacturer of rotary shears, sheet and plate metal working machinery, etc.

R. H. Wilson has been appointed assistant to the president of the Walter A. Zelnicker Supply Co., with an office in St. Louis. Mr. Wilson has been with this company for a number of years, and was its representative in Houston. He was succeeded there by E. O. Griffen, well-known in Southwestern railroad circles.

S. M. Brown is now district manager of sales at 1740 Market St., Philadelphia, Penn., of the Chicago Pneumatic Tool Co. Mr. Brown succeeds G. A. Borden, who will remain in Philadelphia as sales representative of the company. For some time past Mr. Brown has been located in the New York office as assistant manager of the compressor sales division.

F. L. Atwood, formerly factory manager of the Remy Electric Division of the United Motors Corporation, is now vice president and director of production of the Midwest Engine Co., which firm comprises the Lyons-Atlas Engine Co., Indianapolis, and the Hill Pump Co., Anderson, Ind. He has been succeeded by E. F. Creager, formerly assistant works manager, who has been appointed as works manager of the Remy Electric Division of the United Motor Corporation.

Business Items

The Marion Die, Tool and Machine Co., Marion, Ohio has been taken over by Mount Vernon interests, who will continue the business under the same name. W. G. Lake of Mount Vernon has succeeded E. W. Owen as president of the corporation.

The Terminal Machine Co., dealer in new and used machinery, 404-408 Broome St., New York, has leased the building at 458-460 Broome St., containing approximately 60,000 sq.ft. of floor space, to be used as a warehouse for additional machinery it purchased recently.

The Amalgamated Machine Corporation, 72 West Adams St., Chicago, Ill., has purchased all of the assets and good-will of the National Steel Castings Co., New Cumberland, W. Va., and will operate the same as plant No. 2. N. A. Mears, of the Chicago office, who has been associated with the company in the past, has been appointed general manager of the new plant.

The Barber-Greene Co., Aurora, Ill., announces the strengthening of its organization as follows: F. E. Smith, chief engineer, formerly of the engineering department of the Stephens-Adamson Manufacturing Co., of the Granby Mining and Smelting Co. and the American Zinc and Chemical Co.; George C. Sanford, superintendent, formerly of the Elevator Supplies Co. and of the Otis Elevator Co.

The W. J. Crouch Co., Inc., and **Rownson, Drew & Clydesdale, Inc.,** announce the amalgamation of their respective organizations. All trading and manufacturing operations henceforth will be conducted under the name of Rownson, Drew & Clydesdale, Inc., with general offices at 68 William St., New York. P. G. Donald, president of Rownson, Drew & Clydesdale, Inc., will continue in this office, while I. Smullyan, president of the W. J. Crouch Co., Inc., will act as managing director of the new firm. Victor E. Karminski and A. E. Hearne, both treasurer and general manager of the W. J. Crouch Co., Inc., and Rownson, Drew & Clydesdale, Inc., respectively, will in future act as joint general managers of the new concern, Mr. Karminski conducting the Crouch steel division and Mr. Hearne directing all other trading operations. H. Lad Landau, assistant secretary and general sales manager of the W. J. Crouch Co., will continue in the same capacity. So will other leading officers of the company, such as John H. Allen, purchasing agent, who will in the future be assisted by M. Greenberg of Rownson, Drew & Clydesdale, Inc.; Albert Smullyan, comptroller; O. W. Andrews, traffic manager and head of the company's licensing bureau; H. Oppenshaw, advertising manager, and all others occupying positions of trust with the old companies.

Obituary

Captain L. H. Bertsch, Ordnance Department, Cannon Division, and vice president of Bertsch & Co., Cambridge City, Ind., died Oct. 13, 1918.

Edward Hampton Brownell, treasurer of the American Gas Furnace Co. and of E. P. Reichelm & Co. and vice president and treasurer of the American Swiss File and Tool Co., died Oct. 14.

John G. Nichol, treasurer of the Nichol-Straight Foundry Co., Chicago, died Oct. 20 in St. Luke's Hospital, Chicago, of pneumonia following an attack of influenza. He had been for the past 25 years associated with foundries and machine shops in Chicago.

B. Austin Coates, assistant treasurer of the Coates Clipper Manufacturing Co., Worcester, Mass., died of pneumonia Oct. 24. Mr. Coates was born June 2, 1879, and was a graduate of Worcester Polytechnic Institute, was a member of the Commonwealth Club, the Worcester Automobile Club and a member of the York and the Scottish Rite Masons.

L. R. Gulley, general manager of the Burr Co. foundry and machine shops, Champaign, Ill., died Oct. 22, from pneumonia following an attack of influenza. Mr. Gulley was 32 years of age and had been associated with the Burr Co. since his graduation from the University of Illinois in 1910 as a civil and mechanical engineer. He was a member of the Hamilton and Illini clubs of Chicago and of the Champaign Club of Champaign.

Humphrey P. Harrington, mechanical engineer of Indianapolis, died Oct. 20 from a lingering illness extending over two years. He had resided in Indianapolis for 50 years, and for much of that time was with the Atlas Engine Works, traveling extensively over the country as an engine-plant expert. In later years he took charge of a small shop and developed the bicycle chain so well that he witnessed the shop grow into a plant employing 800 people.

William H. Husbands, vice president and one of the organizers of the Standard Metal Co. of Indianapolis, died a few days ago at his home in Indianapolis from hemorrhage of the throat. He distinguished himself as a seller in the metal trade, and for 42 years traveled over the same route, calling upon the shops and foundries in his territory. He was one of the oldest members of the United Commercial Travelers of Indianapolis.

Forthcoming Meetings

The American Society of Mechanical Engineers will hold its annual meeting in New York, Dec. 3-6. The secretary is Calvin W. Rice, 29 West 39th St., New York.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's Hotel. Donald H. C. Tullock, Jr., secretary. Room 41, 166 Devonshire St., Boston, Mass.

The Chamber of Commerce of the United States will sponsor a big convention of war-service committees in Atlantic City, N. J., Nov. 19 to 21, 1918. The following classes of manufacturers will be represented: Gear, wire fencing, jute, store fixture, furniture, textile machinery, foundry equipment, sporting gun and ammunition, warm-air register, furnace, metal hospital furniture, ladder, laundering machinery, naval stores, oil refining and lard substitute, textile pin, safety pin, water-purification apparatus, dandy rolls, stereopticon machine, power pump, gasoline and kerosene vapor lamp, fluorspar, egg case and egg filler, chuck, automatic office device, bobbin and shuttle, germicide and insecticide, clay, oil cloth, bottle and jar cap, brush, button, sensitized photograph paper, tent and awning.

Engineers' Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

The National Founders' Association will hold its twenty-second annual convention at the Hotel Astor, New York, Nov. 13 and 14. The administrative council of the association will meet the day before and on the evening of that day will be held the dinner of the alumni composed of members of former administrative councils. The convention banquet will be held on Wednesday evening, Nov. 13.

New England Foundrymen's Association. Regular meeting, second Wednesday of each month. Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway Cambridgeport, Mass.

The New York State Industrial Safety Congress will hold its third annual session at the Hotel Onondaga, Syracuse, N. Y., Dec. 2-5. Particulars may be obtained from Louis Wiard, 230 Fifth Ave., New York.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadephia, Penn., Howard Evans, secretary, Pier 45 North Philadelphia, Penn.

Providence Engineering Society. Monthly meeting fourth Wednesday of each month. A. E. Thornley, corresponding secretary, P. O. Box 796. Providence, R. I.

Rochester Society of Technical Draftsmen. Monthly meeting, last Thursday. O. L. Angevine, Jr., secretary, 857 Genesee St., Rochester, N. Y.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting, third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Technical League of America. Regular meeting, second Friday of each month. Oscar S. Teale, secretary, 240 Broadway, New York.

Western Society of Engineers, Chicago, Ill. Regular meetings, first, second, third and fourth Mondays of each month, except July and August. Edgar S. Nethercut, secretary, 1735 Monadnock Block, Chicago, Ill.

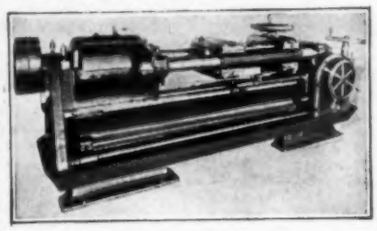
Condensed-Clipping Index of Equipment

Clip, paste on 3 x 5-in. cards and file as desired

Boring Machine for Gasoline-Engine Cylinders

Reed Prentice Co., Worcester, Mass.

"American Machinist," Oct. 24, 1918



A double-bar boring machine for boring the cylinders of gasoline engines. The head unit contains a herringbone gear reduction, the bearings being of bronze with sight-feed oilers. The spindle is hardened and ground on all bearing surfaces and the drive is through a single pulley giving but one spindle speed. The feed is positive gear driven, an automatic positive knockout being provided for the power feed. Rapid movement of the carriage is by means of a handwheel. The carriage moves on round bars instead of on the customary ways, this construction giving support in the direct line of pressure when the machine is in operation, the bars taking the end pressure when the boring is being done.

Surface Plate, Bench

Simplex Tool Co., Woonsocket, R. I.

"American Machinist," Oct. 24, 1918

The plate is of heavy construction, is ribbed on the under side in order that it will not change its shape, and is furnished in two sizes with either a planed or scraped surface as desired. The sizes made at present are 12 x 14 and 20 x 30 inches.

Drill, Motor-Driven

George C. McKay, 4247 Greenlee Ave., Cincinnati, Ohio.

"American Machinist," Oct. 31, 1918

This drill weighs 3¼ lb. and will drill holes in brass or aluminum up to ½ in. diameter and in wood up to ¾ in. in diameter. The motor runs at 10,000 r.p.m., and will operate on either alternating or direct current. The ¼-in. chuck is screwed directly to the armature shaft and the operating switch is located in a convenient position.

Drilling Machine, Automatic Sensitive

Caulkins-Carpenter Co., 564 West Randolph St., Chicago, Ill.

"American Machinist," Oct. 31, 1918

The spindle is operated by a foot lever at the right side of the machine, and a slight movement of this clamps the work while a continued movement feeds the drill to the work. When the proper depth has been reached the spindle is automatically tripped and returned to neutral position and the work is ejected. A positive pump for lubrication is provided in the base of the machine, and oil or drilling compound is forced direct to the point of the drill. A spring collet is located in the hollow spindle which runs on ball bearings. Capacity, up to ⅞ in. in work up to 1 in. in diameter; weight, 350 lb.; bearings, ball type; width of V-belt, 1¼ in.; speed ratio, 750, 1000, 1250, 1500, 2000, 2500, 3000, 4000, 5000, 6000, 8000 and 10,000 r.p.m.

Electro-Stylograph

Electro-Stylograph Co., 1 Madison Ave., New York City.

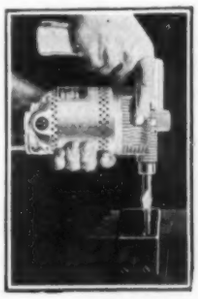
"American Machinist," Oct. 24, 1918

This device is for the purpose of marking tools, gages and other metal parts by means of electricity. The advantage claimed for it is that any name, lettering or design can be easily etched into the parts in a manner similar to that by which a person would letter or draw with a pencil or pen. The part to be marked is placed on a steel plate connected to the controlling apparatus, and the design is worked on with the pointed hand tool. The device operates from the ordinary lamp socket and is portable.

Screwdriver, Motor-Driven

George C. McKay, 4247 Greenlee Ave., Cincinnati, Ohio.

"American Machinist," Oct. 31, 1918

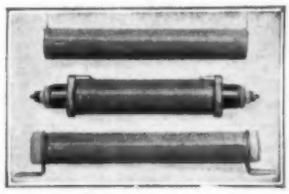


This screwdriver weighs only 5 lb., but it is claimed that it will drive any screw that can be driven with a hand brace. It is equipped with an automatic burn-out protection device that shuts off the current mechanically. The device operates by direct overload and there are no fuses to be burned out. On the machine shown is a handle which covers one of the spindles, but this is held in place by two screws and can be easily removed in case it is desired to use the other spindle which revolves in the opposite direction. If it is more convenient the machine can be used without the handle when both the right and left hand spindles are ready for instant use. The spindles run at 250 r.p.m., but are stationary except when the machine is in use, pressure on the top of the screw engaging a positive driving clutch. The motor runs at 10,000 r.p.m., the speed being reduced through a worm and wormwheel.

Resistance Units, Enameled for Current Regulation

General Electric Co., Schenectady, N. Y.

"American Machinist," Oct. 31, 1918

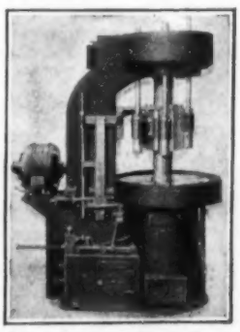


These resistance units are a few of the various forms and sizes now manufactured for current regulation. They have been particularly designed to withstand high temperatures and sudden changes of temperature. The resistance wire or conductor is wound either upon a steel body coated with a special refractory enamel or paint or on a high-heat-resisting silicate compound. The steel body is recommended for extreme lengths or where vibration or shock are present, while the refractory silicate body is for ordinary use. After being wound upon the body the conductor is embedded in blue vitreous enamel which is fused until it has a uniform glossy structure.

Chucking Machine, Automatic Multiple-Spindle, "Daniels"

McDonough Manufacturing Co., Eau Claire, Wis.

"American Machinist," Oct. 31, 1918



Will perform such operations as cup turning, drilling, boring, reaming, facing, tapping with collapsible taps and drilling multiple offset holes by means of multiple-spindle auxiliary heads fitted to the spindles. The machine has five tool-carrying spindles and a blank station. The turret upon which the spindles are mounted does not revolve, but feeds the tools to the work. The table has six chucking positions. The spindles have a rapid approach and a rapid reverse from the work. The table can also be set to index one, two or three spaces. The speeds are varied by means of change gears, and each individual spindle is also provided with change gears in order that it may be set to the most advantageous speed. Capacity, work from 3 to 6 in. diameter; tool-carrying spindles, 5; diameter of table, 36 in.; chucks accommodated, 10 in.

Patented August 20, 1918

WEEKLY PRICE GUIDE OF

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$37.60	$37.60
Northern Basic	34.80	34.80
Southern Ohio No. 2	35.80	35.80
NEW YORK, Tidewater delivery		
Penna. 2X	39.55	39.15
Virginia No. 2	41.70	41.70
Southern No. 2	41.70	41.70
BIRMINGHAM		
No. 2 Foundry	34.00	34.00
PHILADELPHIA		
Eastern Pa. 2X	39.15	38.85*
Virginia No. 2	40.50	40.50†
Basic	36.90	36.60*
Grey Forge	36.90	36.60*
Bessemer	39.10	38.80*
CHICAGO		
No. 2 Foundry Local	34.50	34.50
No. 2 Foundry Southern	39.00	39.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley	35.40	35.40
Basic	34.40	34.40
Bessemer	36.60	36.60

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.245	$4.245	$5.25	$4.17	$5.00	$4.27	$5.00
Soft steel bars	4.145	4.145	5.00	4.07	4.50	4.17	4.50
Soft steel bar shapes	4.145	4.145	5.00	4.17	4.50	4.17	4.50
Soft steel bands	4.745	4.995	.....	.....	.....	.....	.....
Plates, ¼ to 1 in. thick	4.495	4.495	10.00	4.42	7.00	4.25	9.00

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Pittsburgh, mill	$3.50	$4.75
Warehouse, New York	4.75	4.75
Warehouse, Cleveland	4.67	4.95
Warehouse, Chicago	4.10	4.50

STEEL SHEETS—The following are the prices in cents per pound from jobbers' warehouse at the cities named:

	Pittsburgh, Mill, in Carloads	New York			Cleveland		Chicago	
		Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
*No. 28 black	5.00	6.52	6.495	9.50	6.42	8.50	6.52	9.25
*No. 26 black	4.90	6.42	6.395	9.40	6.32	8.40	6.42	9.15
*Nos. 22 and 24 black	4.85	6.37	6.345	9.35	6.27	8.35	6.37	9.10
Nos. 18 and 20 black	4.80	6.32	6.295	9.30	6.22	8.30	6.32	9.05
No. 16 blue annealed	4.45	5.72	5.695	10.20	5.62	8.70	5.72	9.70
No. 14 blue annealed	4.35	5.62	5.595	10.10	5.52	8.60	5.62	9.60
No. 10 blue annealed	4.25	5.42	5.495	10.00	5.42	8.50	5.52	9.50
*No. 28 galvanized	6.25	7.77	7.745	11.00	7.67	10.00	7.77	10.50
*No. 26 galvanized	5.95	7.47	7.445	10.70	7.37	9.70	7.32	10.20
No. 24 galvanized	5.80	7.32	7.295	10.55	7.22	9.55	7.47	10.05

* For painted corrugated sheets add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 5c., all gages.

COLD DRAWN STEEL SHAFTING—From warehouse to consumers requiring at least 1000 lb. of a size (smaller quantities take the standard extras) the following discounts hold:

	Current	One Year Ago
New York	List plus 13%	List plus 25%
Cleveland	List plus 11%	List
Chicago	List plus 13%	List plus 10%

DRILL ROD—Discounts from list price are as follows at the places named:

	Extra	Standard
New York	35%	40%
Cleveland	35%	40%
Chicago	35%	40%

SWEDISH (NORWAY) IRON—The average price pr 100 lb., in ton lots is:

	Current	One Year Ago
New York	$15.50-19	$14.00
Cleveland	20.00	15.00
Chicago	19.00	13.50

In coils an advance of 50c. usually is charged.
Note—Stock very scarce generally.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire*		Cast-Iron Welding Rods	
½, ⅝, ¾, ⅞, 1, 1¼, 1½ No. 8, 1¼ and No. 10	22.10 to 33.00	1/4 by 12 in. long	16.00
		⅜ by 19 in. long	14.00
		½ by 19 in. long	12.00
No. 12		⅝ by 21 in. long	12.00
1¼, No. 14 and 1½ No. 16 No. 20		* Special Welding Wire	
		½	33.00
		⅝	30.00
		¾	38.00

* Very scarce.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Tire	4.14	4.07	4.17
Toe calk	5.75	4.65	4.32
Openhearth spring steel (heavy)	8.00	8.00	7.50
Spring steel (light)	11.00	11.25	11.75
Coppered bessemer rods	9.00	8.00	7.07
Hoop steel	4.77	4.75	4.77
Cold-rolled strip steel	8.02	8.25	8.57
Floor plates	6.27	6.00	6.25

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh; basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

BUTT WELD

Steel Inches	Black	Galvanized	Iron Inches	Black	Galvanized
⅛, ¼, and ⅜	44%	17½%	¼ to 1¼	33%	17%
½	48%	33½%			
¾ to 3	51%	37½%			

LAP WELD

2	44%	31½%	2	26%	12%
2½ to 6	47%	34½%	2½ to 4	28%	15%
			4½ to 6	28%	15%

BUTT WELD. EXTRA STRONG PLAIN ENDS

⅛, ¼ and ⅜	40%	22½%	¼ to 1¼	33%	18%
½	45%	32½%			
¾ to 1¼	49%	36½%			

LAP WELD. EXTRA STRONG PLAIN ENDS

2	42%	30½%	2	27%	14%
2½ to 4	45%	33½%	2½ to 4	29%	17%
4½ to 6	44%	32½%	4½ to 6	28%	16%

Stock discounts in cities named are as follows:

	New York Black	New York Galvanized	Cleveland Black	Cleveland Galvanized	Chicago Black	Chicago Galvanized
¼ to 3 in. steel butt welded	40%	28%	41%	26%	41.1%	26.1%
3½ to 3 in. steel lap welded	36%	25%	37%	23%	37.1%	23.1%

Malleable fittings. Class B and C, from New York stock sell at list + 15%. Cast iron, standard sizes, 5% off.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	26.00*	26.00	23.50
Tin in 5-ton lots	78.50	83.00	62.00
Lead	8.05	8.55	6.25
Spelter	9.20	9.50	8.25

* Government price.

ST. LOUIS

Lead	7.75	8.25	7.75
Spelter	8.85	9.25	8.00

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Copper sheets, base	38.00	38.00	35.00	38.00	33.00	38.00	34.00
Copper wire (carload lots)	35.00	35.00	38.50	35.00	33.00	38.00	33.50
Brass sheets	39.75	39.75	40.00	40.50	33.25	38.00	35.00
Brass pipe	46.00	46.00	43.00	42.50	41.00	44.00	42.00
Solder (half and half) (case lots)	58.00	58.00	39.25	50.50	37.00	65.00	39.00

Note:—Solder very scarce.

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 1c.; polished takes 1c. per sq.ft. extra for 20-in. widths and under; over 20 in., 2c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; 25% to be added to mill prices for extras; 50% to be added to warehouse price for extras:

	Current	One Year Ago
Mill	$37.75	$29.00
New York	34.25	35.00
Cleveland	38.50	34.00
Chicago	29.50	37.00

SHOP MATERIALS AND SUPPLIES

ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill 15.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	18.75	20.00	18.40	20.50
New York	17.00	21.00	17.50	21.25
Chicago	22.00	21.00	21.50	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots, for spot delivery, duty paid:

	Current	One Year Ago
New York	13.50	15.00
Chicago	15.50	16.25
Cleveland	16.00	16.06

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York		Cleveland		
	Current 1918	One Year Ago	Current 1918	One Year Ago	Chicago
Copper, heavy and crucible	24.00	24.00	24.00	24.75	21.50
Copper, heavy and wire	22.50	23.00	23.50	24.00	21.00
Copper, light and bottoms	20.50	21.00	21.50	22.00	21.00
Lead, heavy	7.25	8.00		8.00	6.50
Lead, tea	5.50	6.75	7.50	6.00	6.20
Brass, heavy	14.75	15.25	16.50	17.00	21.00
Brass, light	11.00	11.50	12.50	13.00	12.50
No. 1 yellow brass turnings	13.75	16.25	14.00	16.00	15.00
Zinc	6.50	6.00	6.00	6.00	5.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, guaranteed over 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.20c.	32.30c.	33½c.

This is the Government price for lots of from 1 to 14 tons.

COPPER BARS from warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York	32.00	41.00
Chicago	38.00	41.00
Cleveland	36.50	39.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	95.00	70.00	93.00	69.75	96.00	70.00
Commercial	50.00	40.00	23.00	24.50	25.00	25.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	$2.50*	List	$1.25	$1.65	$0.98	$2.00
Hot pressed hexagon	2.50*	List	1.05	1.50	.78	2.00
Cold punched hexagon	2.50*	List	.75	1.25	1.00	1.50
Cold punched square	2.50*	List	.75	1.25	1.00	1.50

* List plus.

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50%
Chicago	50%	50%
Cleveland	50+10%	50%

MACHINE BOLTS—Warehouse discounts in the following cities.

	New York	Cleveland	Chicago
½ by 4 in. and smaller	30%	40+10%	37%
Larger and longer up to 1 in. by 30 in.	15%	20+ 5%	25—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price.

For wrought-iron washers:

New York..... $2.50 Cleveland..... List Chicago..... $2.50

For cast-iron washers the base price per 100 lb. is as follows:

New York..... $5.00 Cleveland..... $4.25 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	30%	45%	32½%
Larger and longer up to 1 in. by 30 in.	15%	20+5%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	List plus 10%	List plus 10%	List plus 10%	List plus 10%
Chicago	List price	List price	List plus 20%	List price
New York	20% from list	List plus 10%	List plus 20%	10-2½% from list

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel 7/16 and smaller	30%	45—5%	40%
Tinned	30%	45—5%	40%

Button heads, ½, ⅝, 1 in. diameter by 2 in. to 5 in. sell as follows per 100 lb.

New York...$5.65 Cleveland...$5.15 Chicago....$5.67 Pittsburgh...$4.65

Coneheads, same sizes:

New York...$5.75 Cleveland...$5.25 Chicago....$5.77 Pittsburgh...$4.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	51.00	38.00	39.50
Brass	42.00	40.00	44.00

For immediate stock shipment 3c. is usually added. The prices of course vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., the advance is 2½c. over base (100-lb. lots); for less than 50 lb. but not less than 25 lb., 5c. should be added to the base price; and for quantities under 25 lb. the increase above base is 10c.

TIN PLATES—Warehouse prices per box:

Coke tin plate, 14 x 20:

	Cleveland		Chicago	
	Current	One Yr. Ago	Current	One Yr. Ago
100 lb	$9.17½	$12.00	$10.60	$11.75
I. C. 107 lb	9.42½	12.17½	10.70	11.90

Terne plate, 20 x 28:

Base Weight	Net Weight	Coating				
100 lb.	200	3	18.95	18.95	19.10	17.90
I. C.	214	8	19.25	19.25	19.40	18.25
I. C.	270	8	21.75	21.75	21.40	20.35
I. C.	218	12	21.75	21.75	22.60	19.25
I. C.	221	15	22.50	22.50	22.10	19.50
I. C.	226	30	23.25	23.25	22.60	20.50
I. C.	231	25	24.50	24.50	23.10	21.30
I. C.	236	30	25.75	25.75	23.60	22.25
I. C.	241	35	26.75	26.75	25.10	23.25
I. C.	246	40	28.00	28.00	25.60	24.55

NOTE—New York prices furnished on application to dealers. Price varies according to whether the plates are wanted for work essential to the war or for nonessential work.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	11.00 to 13.00	13.00	16.50	12.00 to 16.50
Colored mixed	8.50 to 12.00	12.00	13.00	11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	52.00	58.00
Chicago	48.00	50.00

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$1.75	$1.75	$1.75
Philadelphia	1.75	1.75	1.75
Cleveland	2.40	2.40	2.10
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$4.30	$4.30	$4.30
Cleveland	4.60	4.60	4.50
Chicago	4.00	4.00	3.80

COKE—The following are prices per net ton at ovens, Connellsville, and cover the past four weeks:

	Oct. 31	Oct. 24	Oct. 17	Oct. 10	Oct. 3
Prompt furnace	$6.00	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Chicago	450-lb. bbl.	$2.50
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels	$1.61	$1.23	$1.90	$1.30	$1.65	$1.27
5-gal. cans	1.76	1.33	2.00	1.40	1.85	1.37

WHITE AND RED LEAD in 500-lb. lots sells as follows in cents per pound:

	Red				White	
	Current		1 Year Ago		Current	1 Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	14.00	14.50	12.25	12.50	14.00	12.50
25 and 50-lb. kegs	14.25	14.75	12.50	12.75	14.25	12.25
12½-lb. keg	14.50	15.00	12.75	13.00	14.50	12.50
5-lb. cans	....	....	14.25	14.00	16.00	14.50
1-lb. cans	....	....	14.25	14.50	17.00	14.50

NEW *and* ENLARGED SHOPS

Consult the Buying Section when in need of machinery or supplies

WASHINGTON, D. C.

The Navy aims to give information regarding its purchases to all manufacturers known to be in a position to supply its demand. Owing to the need of prompt action in the cases of all machine tools hereinafter listed, the Navy cannot arrange to permit a postponement of the opening of bids if the manufacturers are able to secure bidding forms and submit their bids prior to date fixed for opening.

In case time does not permit this, it will be appreciated if any manufacturer not receiving information directly regarding these purchases will notify the Purchasing Division, Bureau of Supplies & Accounts, Navy Department, Washington, D. C., in order that the firm's name may be properly listed for all future purchases.

The Bureau of Supplies and Accounts, Navy Department, will receive bids furnishing machines and machine tools as follows:

Schedule No. 6640¼, 1 lathe and 1 press drill, delivery Mare Island (Vallejo P. O.), Calif.

Schedule No. 6662¼, 3 emery grinders, delivery Norfolk, Va.

Schedule No. 6678¼, double end and center driven grinders, delivery Washington, D. C.

Schedule No. 6679¼, milling and grinding machines, lathes, shear, etc., delivery f.o.b. works.

Schedule No. 6680¼, 2 die sinking machines, delivery Norfolk, Va.

Schedule No. 6682¼, one 20 in. shaper, delivery Newport, R. I.

Schedule No. 6683¼, 1 milling machine, delivery Washington, D. C.

Schedule No. 6684¼, 1 cylinder bore machine, delivery Norfolk, Va.

Schedule No. 6707¼, 1 milling machine, delivery Newport, R. I.

Schedule No. 6709¼, 1 squaring shear, delivery Philadelphia, Penn.

Schedule No. 6711¼, 10 milling, grinding and boring machines and tool grinders, delivery Washington, D. C.

Schedule No. 6712¼, polishing, grinding and clamp machine, delivery Puget Sound (Bremerton P. O.), Wash.

Schedule No. 6717¼, 1 cutting-off saw delivery Key West, Fla.

Schedule No. 6723¼, 1 cutting machine, delivery San Diego, Calif.

Schedule No. 6724¼, lathe chucks, delivery Key West, Fla.

Schedule No. 6725¼, 1 re-saw band, delivery Boston, Mass.

Schedule No. 6731¼, machine tools, including lathes, drills, grinders, tapping machines, hand press machines, etc., delivery New London, Conn.

Schedule No. 6739¼, 24,000 hack saw blades, delivery Mare Island (Vallejo P. O.), Calif.

Schedule No. 6744¼, 1 sand blast machine, delivery Boston, Mass.

Schedule No. 6746¼, brass shapers, delivery Boston, Mass.

METAL WORKING

NEW ENGLAND STATES

Conn., New Britain—Landers, Frary & Clark, Commercial and Center St., manufacturer of cutlery and hardware, has awarded the contract for the erection of a 1-story, 80 x 108 ft. tempering room addition to its plant. Estimated cost, $15,000.

Mass., East Boston (Boston P. O.)—The Atlantic Works, 80 Border St., manufacturer of steam engines, has acquired a site adjoining its plant on New St. and plans to enlarge its plant.

Mass., Hanover—The National Fire Works Co., King St., plans to build a munition plant. Address G. N. Clark.

MIDDLE ATLANTIC STATES

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal, Wash., will receive bids until Nov. 11, for furnishing machine shop equipment at the Isthmus of Panama.

Md., Baltimore—K. B. Bell plans to rebuild his machine shop which was recently destroyed by fire.

Md., Baltimore—The Novelty Steam Boiler Works, South Howard St., is building a 2-story, 20 x 75 ft. addition to its plant. Estimated cost, $5000. Noted Oct. 10.

Md., Highlandtown (Baltimore P. O.)—The Crown Cork and Seal Co., Guilford Ave., Baltimore, is building a plant here, for the manufacture of ammunition. Estimated cost, $30,000.

Md., Mount Washington (Baltimore P. O.)—The Monkton Roller Mills is in the market for roller-mill machinery. O. E. McCoy, Pres.

N. J., Bloomfield—The International Arms and Fuse Co., Grove St. and Bloomfield Ave., has awarded the contract for the erection of a 100 x 200 ft. addition to its plant. Estimated cost, $17,000. Noted Sept. 19.

N. J., East Orange—The Sprague Electric Co., Lawrence St., has awarded the contract for the erection of a 2-story, 60 x 163 ft. grid and pattern shop. Estimated cost, $50,000. Noted Oct. 10.

N. J., Newark—Franz-Holbrook Bronze Co., 200 Berkeley Ave., has had plans prepared by W. E. Lehman, Arch., 736 Broad St., for a 1-story, 61 x 107 ft. light foundry plant with 20 x 39 ft. wing and a 1-story, 29 x 76 ft. shed, to be erected at 325-335 Bloomfield Ave. Estimated cost, $15,000.

N. J., New Brunswick—The Wright-Martin Aircraft Corporation, Aviation Field Stelton, manufacturer of airships, has awarded the contract for the erection of a 1-story, 52 x 54 ft. foundry addition and heat treating plant.

N. Y., Buffalo—The Buffalo Pressed Steel Co., 800 Kensington Ave., has had plans prepared for the erection of a 1-story, 20 x 35 ft. and 25 x 50 ft. addition to its plant on Liberty and Kensington Ave. Noted Aug. 29.

N. Y., Buffalo—F. G. Krone, West Ferry St., plans to remodel his plant for the manufacture of machine parts.

N. Y., Buffalo—The Prest-O-Lite Co., 206 Amsterdam Ave., New York City, manufacturer of gas tanks, has awarded the contract for a 1-story plant consisting of 4 buildings to be erected on Hopkins St. and Colgate Ave. Estimated cost, $100,000. Noted Oct. 10.

N. Y., Buffalo—The Strong Steel Co., 33 Norris St., has awarded the contract for the erection of a 1-story, 50 x 100 ft. foundry addition.

N. Y., Buffalo—The United States Drawn Steel Co., Fidelity Bldg., has awarded the contract for the erection of an addition to its plant. Noted Oct. 24.

N. Y., Buffalo—The Worthington Pump and Machinery Co., 2 Roberts St., will build a 1-story transformer house. Estimated cost, $4000.

N. Y., Dunkirk—The Atlas Crucible Steel Co., Marine Bank Bldg., Buffalo, plans to build a 1-story, 80 x 100 ft. addition to its plant on Howard Ave., here.

N. Y., Elmira—The Eclipse Machine Co., Elmira Heights, has awarded the contract for the erection of two 2-story, 50 x 100 ft. and 36 x 40 ft. and two 1-story, 60 x 108 ft. and 45 x 100 ft. additions to its plant. E. J. Dunn, Pres.

N. Y., Elmira—The James Manufacturing Co., 700 Madison Ave., manufacturer of dairy and farm equipments, plans to build an addition to its plant.

N. Y., Lockport—The McKim Foundry and Machine Co., 64 Lockport St., has increased its capital stock from $200,000 to $1,500,000 and plans to enlarge its plant.

N. Y., New York (Borough of Bronx)—The De La Vergne Machine Co., foot of 138th St., is in the market for a No. 33 Lucas or equivalent boring, drilling and milling machine.

N. Y., New York (Borough of Brooklyn)—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until Nov. 11, for building light machine and electrical shop at the Navy Yard, here. Estimated cost, $800,000.

N. Y., New York—(Borough of Brooklyn)—The Oldham New York Saw Works, foot of 26th and 27th St., is in the market for an engraving machine for putting the divisions and sub-divisions of inches and millimeters, also numerals of steel rules, such as used by machinists.

N. Y., New York (Borough of Manhattan)—The Consolidated Rolling Mills, 25 Broad St., is in the market for wool washers, wool pressing machines, wool presses and all machinery for handling woolen products.

N. Y., New York (Borough of Queens)—S. Blickman, 199 Lafayette St., New York City, manufacturer of heavy sheet metal and stamping products, is having plans prepared for a 5-story, 200 x 600 ft. factory to be erected on Mott and Anable Ave., Manby and Mount St., Long Island City.

N. Y., New York—(Borough of Richmond)—The Standard Ship Building Corporation, Shooter's Island, is in the market for an angle bar planing machine.

N. Y., Niagara Falls—The Ferguson Iron and Steel Co., 1399 Bailey Ave., is building a 1-story, 40 x 60 ft., addition to its plant. Estimated cost, $10,000.

N. Y., Phoenix—The Three Rivers Machine Tool and Die Co. has increased its capital stock from $30,000 to $130,000 and plans to enlarge its plant.

N. Y., Poughkeepsie—The Poughkeepsie Cutlery Works, North Cherry St., plans to build a 4-story, 75 x 125 ft. addition to its factory.

N. Y., Tonawanda—The Pierce Arrow Motor Car Co., Elmwood Ave., Buffalo, has awarded the contract for a 1-story, 100 x 260 ft. testing and assembling works to be erected on River Rd. Noted Oct. 31.

Penn., Bedford—The Tile Waterpipe Co. plans to build a 3-story machine shop. Estimated cost, $15,000.